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DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA.

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FOREWORD.

The Departmental House Journal.

Since the end of 1909 this State has been without an Agricultural Journal, although for the previous 14 years one had been published regularly. Commencing in 1894 as the "Journal of the Bureau of Agriculture" it assumed the title of "Journal of the Department of Agriculture" when, in 1899, the Bureau attained the dignity of a Government Department under the control of its own Minister. Under this title it appeared without intermission until the end of 1909.

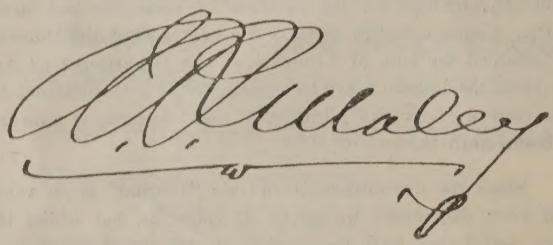
Since the discontinuance of this "Journal" much valuable information has been distributed by means of Bulletins, but whilst these have proved very useful they were too specialised and not of a sufficiently general character to serve the same effective purpose as the regular issue of a "Journal" with its diversified information.

The increasing number of settlers—many of whom are inexperienced—due to the vigorous land development policy of the Government, is creating a demand for technical agricultural information from my Department which cannot be met adequately without our own "house" journal. To meet this need I have decided to re-establish "The Journal of Agriculture." The Bulletins on special subjects will still be issued, but now chiefly as reprints from the "Journal."

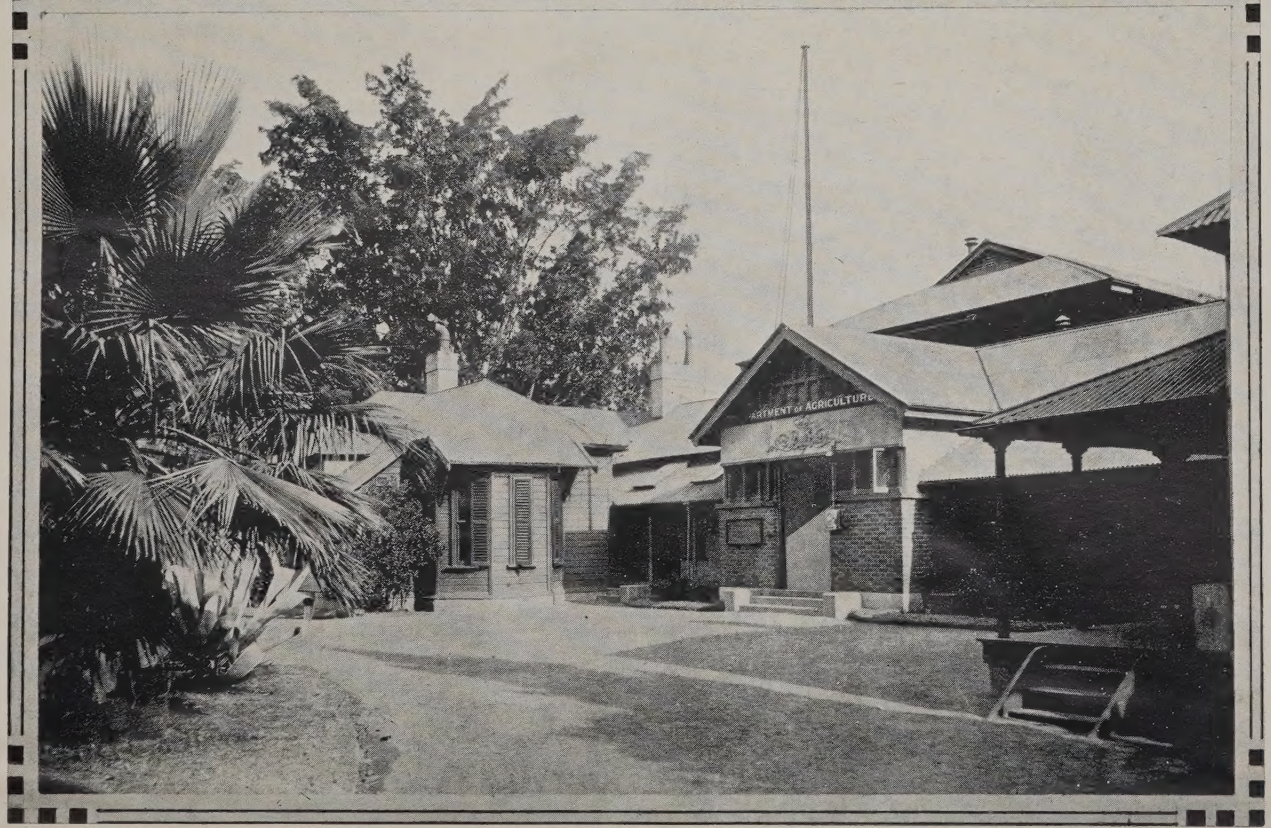
Another aim I have in re-establishing the "Journal" is to increase Western Australian sentiment amongst the agricultural community, which cannot be fostered without the publication of a Departmental "Journal." The information contained in the Eastern States' Journals is widely read in this State, and is extremely valuable in guiding and stimulating agricultural thought, but Western Australia has its own agricultural problems, and the information obtained from those Journals cannot take the place of the information derived from the original work which should be and is done by the Departmental specialists here. The dissemination of the results of their work in connection with the solving of our special problems should tend to create greater self-reliance in connection with agricultural progress amongst our own people and bring the farmers and the Department into closer contact. It is believed that the regular publication of these results in an agricultural

journal is the method by which the greatest effect in this direction can be achieved. The issue of such a journal will further permit the work done being made known outside as well as within the State, and will also permit our specialists, who are men of standing and repute, to enhance their reputations in the agricultural world. It will at the same time remove another link from the chain of isolation which has so long surrounded this State, but which is being slowly and surely sundered.

It gives me pleasure to acknowledge the splendid service which the Western Australian Press has hitherto rendered by collecting and distributing the information prepared by the Departmental specialists, and it is not intended that this service shall be supplanted, but it will be supplemented by the *Journal of Agriculture*.



Minister for Agriculture.



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DEPARTMENT OF AGRICULTURE: ITS ORGANIZATION AND ACTIVITIES.

Geo. L. Sutton,

Director of Agriculture.

The present Department of Agriculture, with its many and increasing ramifications in the rural life of the State, had its beginning in an unostentatious manner. With the inception of responsible Government in 1890 the agricultural possibilities of the new State were recognised by the then Premier, the late Lord Forrest. The first step taken was to appoint a Bureau of Agriculture for the purpose of advising the Government concerning the proper methods to be adopted in establishing Agriculture as one of the State's industries.

The members of the Bureau were: Messrs. Charles Harper (Chairman), J. C. H. Amherst, W. Paterson, F. H. Piesse and A. R. Richardson; and, with the exception of the last named, who was succeeded in 1895 by Mr. F. Craig, the personnel remained unchanged until 1898, when the Department of Agriculture was constituted and placed under the control of the then Commissioner for Lands and Agriculture, the late Hon. George Throssell.

The Secretary to the Bureau and the first Secretary for Agriculture was the late Mr. L. Lindley-Cowen, and in his communication to the Minister suggesting the constitution of a Department instead of a Bureau, Mr. Lindley-Cowen's remarks read significantly to-day. He wrote, *inter alia*—

> "Is is better to be accused of being too far ahead of the times than behind them. The average agriculturist is slow to learn, and I would suggest that every effort should be made to instruct the people boldly in the possibilities of the future and let the present, which is prosperous, take care of itself."

The Hon. George Throssell appended the following minute to that recommendation:—

> "Excellent. We shall succeed. The education of the people is our first duty, and must be regarded as one of the main factors to national wealth."

And thus, in a spirit of advancement, the Department of Agriculture came into existence.

The expenditure of the Bureau of Agriculture during the last year of its existence was £5,500. Last year the total expenditure of the Department, including its business undertakings, exceeded £98,000, and the Department had a revenue of almost £72,000. With this great increase in expenditure and revenue there has been a corresponding increase in the staff and activities of the Department in the endeavour to keep pace with the expanding development of the State and of the particular industry it is intended to serve.

At the time Mr. Lindley-Cowen was Secretary the Mining Industry was paramount in the State; since then it has declined, while agriculture has increased to such an extent that to-day it is the most important, and mining has to take second place.

The Department is housed in an old historic building situated in St. George's Terrace between the Government Gardens and Government House. At one time this building housed the whole of the Government Departments of the State with the exception of the Post Office, and afterwards it was used by the Legislative Council as its Legislative Chamber. The Executive Council also met there until 1911.

At the head of the Department is the Minister, the Hon. H. K. Maley, who is responsible to Parliament for the policy and acts of the Department. He has as the Permanent Head the Director of Agriculture, whose duty it is to see that the wishes of the Minister are carried into effect, and who is responsible to him for the work of the Department. The Director is assisted by the Secretary, Mr. L. St. J. Jones.

The Department is composed of an Administrative Staff under the Secretary, and a number of branches or divisions, together with Experiment and Seed Farms. The branches are in charge of scientific and technical officers and, whilst each is self-contained, co-operation exists between them, and their work is directed and co-ordinated by the Director.

Details regarding the staff and functions of the different branches are given hereunder.

VETERINARY BRANCH.

This Branch consists of the Chief Inspector of Stock, two Veterinary Officers, two Stock Inspectors, and a Poultry Inspector. In a State like Western Australia, with such large areas devoted to agricultural and pastoral interests, the Veterinary Branch has always held, and will always hold, a very important place in the Department. The Chief Inspector of Stock, Mr. R. E. Weir, M.R.C.V.S., is at present on leave pending retirement, and the Branch is being administered by Mr. A. L. McKenzie Clark, L.V.Sc.

The principal duty of the Branch is the prevention of the introduction of diseases from without the State and the prevention and control of diseases, particularly those of an infectious and contagious nature, within the State.

Other functions are to furnish to owners information on stock ailments; to certify as to the value and soundness of stock purchased by clients of the Agricultural Bank, and to maintain the horse requirements of all Government Departments.

The Branch also controls the registration of brands and the registration of stallions, the object of the latter being the improvement in the quality of horses within the State.

Under the Veterinary Act, 1911, it is provided that a Board shall be constituted and called the Veterinary Board, such Board to consist of five members to be appointed from time to time by the Governor. At the present time the Board consists of Messrs. A. L. McKenzie Clark, L.V.Sc., E. A. LeSouef, B.V.Sc., John Robson, M.R.C.V.S., Edwin Rose, and M. G. Bodey.

The following Acts are administered by the Branch:—

"Slaughter of Calves Restriction Act."
"Veterinary Act."
"Droving Act."
"Brands Act."
"Stock Diseases Act."
"Commonwealth Quarantine Act (Animals)."
"Stallions Act."
"Cattle Trespass Act."

HORTICULTURAL BRANCH.

The Staff consists of the Officer in Charge, of Fruit Industries, Mr. George W. Wickens, and 12 Orchard, Market, and Fruit Inspectors.

The appointment of a Viticulturist is now under consideration.

The function of this Branch is to obtain information and advise fruitgrowers and intending fruitgrowers with regard to the suitability of land for horticultural purposes; the different varieties of fruit and their adaptability to various localities; the best method of cultivation; how to combat diseases and pests, and also regarding systems of management and marketing.

An important duty of this Branch is the administration of the Commonwealth Quarantine Act (Plants), the object of which is to prevent the introduction of plant diseases and pests into this State. As a result of its activities in this direction, and pest control within the State, the apple growers are free from the dire effects of the Codlin Moth.

Mainly by personal visits to orchards, but also at meetings, the fruitgrowers are assisted in all matters appertaining to their calling.

This Branch deals with matters relating to the regulation of the export and local trade, such as sizes of cases, grades of fruit; also inspection of fruit in the markets for local consumption, and at the sea-ports for export. It has also to administer the following Acts:—

"Insect Pests Act."
"Fruit Cases Act."
"Plant Diseases Act."
"Commonwealth Quarantine Act (Plants)."
"Noxious Weeds Act."
"Contagious Diseases in Bees Act."
"Commonwealth Commerce (Trade Description) Act."

DAIRY BRANCH.

The officer in charge of this Branch is Mr. P. G Hampshire, the Dairy and Pig Expert. He controls a staff consisting of two Agricultural Advisers, two Herd Testers, the Busselton Butter Factory staff, and the manager and employees of the Denmark Stud Farm.

The principal functions of the Branch are to stimulate the dairying and pig-raising industries by assisting the producers and manufacturers with technical advice in the production, care, and manufacture of dairy produce; the laying down of pastures; growth of fodder crops; selection and care of dairy stock, and the testing of pure-bred herds and keeping of milk and fat records with the object of raising the quality of the dairy stock throughout the State.

Included in the duties of the officers of the Branch is the administration of "The Dairy Industry Act, 1923," which regulates the manufacture, grading storage, transit and export of dairy produce, and the examination and certification of testers and graders of dairy produce. Included also is the administration of "The Dairy Cattle Improvement Act, 1923," which regulates the inspection and registration of all bulls over the age of nine months, and has for its object the improvement of the future herds of this State. All Government stud dairy cattle are under the control of the Branch.

At the Denmark Stud Farm is a stud of Guernsey cattle established with the object of raising pure pedigreed tested bulls for distribution to Group Settlements in the Guernsey Zone adjoining, together with a stud of pedigreed Berkshire pigs and a pure Clydesdale stallion.

Generally, the Dairy Branch, through its staff of qualified Agricultural Advisers and Testers, aims at encouraging the expansion of the dairy industry along the lines based on local experience and the most modern scientific methods.

IRRIGATION AND DRAINAGE BRANCH.

The staff of this Branch consists of the officer in charge, Mr. A. R. C. Clifton, and his assistant.

Its function is to advise farmers in connection with irrigation and drainage projects. The officers are continually in the field taking levels and giving instructions in the correct method of grading, and raising the water and conveying it on to the land, for which purpose advice is also rendered as to the most suitable plant to be employed.

Grading work is carried out at cost price.

Problems affecting farm and orchard drainage are investigated and reported on and, if desired, the levels are taken and the work of grading the land for irrigation is carried out by this Branch. It is also charged with the work of determining the possibilities of tobacco growing in the agricultural areas of the South-West.

WHEAT BRANCH.

At the head of this Branch is Mr. I. Thomas, recently appointed as Superintendent of Wheat Experiment Farms. He has under his control a Field Officer and an Agricultural Adviser, and the staffs of the Experiment

and Seed Farms. The function of the Branch is to disseminate information concerning the cultivation of cereals and cognate matters in the Wheat Belt. To assist in this direction experiments, which are carried out on farmers' holdings, are planned and supervised, and arrangements made for the display of Departmental exhibits of produce at country shows. The Branch has also taken an active and prominent part in the organising and judging of District and State Crop Competitions.

The branch officers undertake the inspection of wheat and flour intended for export, and the issue of certificates regarding the weight and quality of same. This work had a small beginning just prior to the war, but has increased very considerably, and this is largely due, it is believed, to the care taken in connection with the inspection and the value which as a result has been placed upon the certificates.

The branch also administers the Fertiliser Act, by means of which the control and sale of fertilisers is regulated.

EXPERIMENT FARMS.

Attached to the Wheat Branch are a Light Land Demonstration Farm at Wongan Hills, now being established, the recently acquired Avondale Seed Farm at Beverley, and two Experiment Farms. One of these, the Chapman Experiment Farm, is established at Nabawa, 25 miles north of Geraldton, and almost at the extreme north of the agricultural areas; and the other, the Merredin Experiment Farm, at Merredin, on the western fringe of the Wheat Belt. The Chapman Farm is at present managed by the Superintendent (Mr. I. Thomas); that at Merredin by Mr. J. H. Langfield. At each farm there is, including the Manager, a staff of five.

Their principal function is the growing of pure pedigree seed of the main varieties of wheat for sale to farmers, thus ensuring a source from which settlers can obtain fresh supplies of seed true to name and free from impurities. Allied to this work is the production by selection and cross-breeding of new varieties of cereals and fodder crops suitable for cultivation in the Wheat Belt. These farms are actively engaged in conducting experiments having for their object the discovery of information which will lead to improvement in the yield of wheat and reducing the cost of production. Such experiments relate to the best methods of dealing with the soil, the use of fertilisers, amount of seed to use, and the best varieties of different crops to grow. The farms are conducted solely for educational and experiment purposes, and not as commercial enterprises, though the strictest economy is observed in their administration. Farmers are encouraged to visit the farms at all seasons, and in the early summer special Field Days are held which are largely attended by farmers.

SHEEP AND WOOL BRANCH.

The Sheep and Wool Inspector, Mr. Hugh McCallum, has charge of this Branch. His duties include lectures, demonstrations on sheep and wool, and visits to settlers' holdings to give personal practical instruction in modern methods of preparing the farmer's clip for the market. The underlying motive of the Sheep and Wool Inspector's efforts is the improvement of the standard of farmers' flocks by selection and culling, and proper classing of their wool

clips to ensure the maximum market price being obtained. When he is unable to personally visit a farmer or a district he is always prepared to deal with any matter of importance by means of correspondence.

POTATO BRANCH.

The Senior Potato Inspector, Mr. G. N. Lowe, carries out the functions of this Branch with the assistance of two potato inspectors. Farmers and settlers generally are advised on all matters connected with the growing and marketing of potatoes and other vegetables. They are also instructed in matters appertaining to the control of insect pests and fungi, and the precautions to be taken to eradicate diseases. The administration of the Plant Diseases Act, so far as it concerns potatoes, onions, and vegetables, is one of the most important functions of the Branch.

Officers of this branch inspect all potatoes imported into the State with the main object of preventing the introduction of Irish Blight and Eel Worm. Potatoes which are exported are also inspected in order to ensure that only those of satisfactory quality are sent out, and thus maintain the high reputation which the State has achieved for this product.

This branch has initiated and controls a system of potato seed certification, whereby potato crops intended for seed by the growers are inspected and certified to if true to name and free from disease.

Inspections are also made in the local markets to prevent the distribution of vegetables which may be diseased, and at the same time to locate the origin of any disease with a view to its eradication or control. Systematic visits to market gardens are made for the same purpose.

BOTANICAL AND PLANT PATHOLOGICAL BRANCH.

The Economic Botanist and Plant Pathologist of the Department, Mr. W. M. Carne, with the aid of an assistant, carries out the important work entailed upon this Branch. Advice is given to farmers and others upon botanical matters generally, and especially in regard to economic plants, weeds, and poison plants. Plants are identified, and the merits of useful plants, also the methods of eradicating weeds and poisonous plants, are investigated.

Plant diseases, their identification and investigation, and the best methods of controlling or eradicating them, is another responsibility of the Branch, regarding which a great deal of valuable information has been gathered and disseminated. Advice regarding the eradication or control of particular plant diseases is also furnished to farmers.

Testing agricultural seeds is another function of the Branch, and it administers the Agricultural Seeds Act and acts in an advisory capacity under the Commonwealth Quarantine and Commerce Acts.

ENTOMOLOGICAL BRANCH.

The staff of this Branch consists of the Economic Entomologist, Mr. L. J. Newman, and an assistant.

The functions of the Branch, which include Forestry Entomology, deal with: The investigation of the life histories of both beneficial and destructive

insects; the identification of insects; the introduction, establishment and distribution of beneficial insects; the carrying out of experiments to control destructive insects; and the dissemination, by correspondence, publications, demonstrations, and per medium of lectures, of information regarding beneficial or destructive insects.

The Entomologist also acts as adviser under the Commonwealth Quarantine and Commerce Acts.

THE VERMIN BRANCH.

The staff consists of the Acting Chief Inspector of Rabbits, Assistant, four Fence Inspectors, three Rabbit Inspectors, 31 Boundary Riders, and Gangers.

The functions of the Branch are to maintain the existing rabbit proof fences, administer the Vermin Act and endeavour to eradicate vermin.

The fences are continually patrolled by the inspectors, who employ gangs to keep them in efficient repair. Other gangs are also employed to lay poison on the worst of the breeding grounds. The efforts of the Branch are supplemented by numerous Vermin Boards appointed throughout the State, whose duty it is to eradicate vermin within their various districts. These Vermin Boards are encouraged to do this, and, as an incentive to deal with the dingo pest, the Department supplements the bonuses paid by the Boards with an additional amount.

ABATTOIRS AND REFRIGERATING BRANCH.

The staff of this Branch is controlled by Mr. E. H. Golding, Acting Controller of Abattoirs. Under the Abattoirs Act it is essential that the whole of the slaughtering for the Metropolitan Area be done at the Government Abattoirs, which are located at Midland Junction and South Fremantle.

The Perth Markets are controlled by this Branch, also the Refrigerating Works, in which fruit, meat, and other perishable food products are kept in cool storage to prevent contamination and deterioration during the period which elapses before they are passed into human consumption. The ice requirements of all the Government Departments are supplied by the Refrigerating Works.

AGRICULTURAL CHEMIST'S BRANCH.

The chemical work of the Department is carried out in the Government Analytical Laboratory under the control of Dr. E. S. Simpson. Special facilities are afforded to farmers to have carried out in the Laboratory any chemical work they may desire in connection with their farming operations. The charges for this work are very moderate.

An important feature of the Laboratory work is the testing of the milling qualities of the new wheats produced at the Experiment Farms and of the wheats competing at the Royal Agricultural Society's Annual Show. For this purpose a specially constructed miniature mill has been installed, so that flour and other products can be milled from a small quantity of wheat in a manner similar to that obtained from large quantities in a commercial mill. In this connection millers may also have wheat and flour tested at reasonable rates.

TROPICAL AGRICULTURE.

In August of last year the Department recognised the advisability of encouraging agricultural pursuits in the North-West by appointing Mr. F. J. S. Wise as Agricultural Adviser for that division. His duties are principally to obtain information regarding the suitability of the land for various crops, and to give advice to the settlers as to the best methods of cultivation to follow. It is intended to establish a small experiment station at Broome to ascertain the suitability of the district for growing tropical crops, and this will be placed under Mr. Wise's control. In the meantime, he travels widely through the North-West for the purpose of giving practical advice and demonstrations to those settlers whom he can reach.

PUBLICITY BRANCH.

This Branch has just been added to the Department. The Publicity Officer is Mr. J. Buzza, and his chief function is the publication of the *Journal of Agriculture,* which, until the present issue, has not been published since September, 1909. In addition he is responsible for supplying the Press generally with information concerning the operations of the Department which are of immediate interest to the agricultural world, and generally attending to matters which come under the heading of Publicity.

AGRICULTURAL CADETSHIPS.

In order to have trained officers available to fill vacancies as they occur, a number of Cadets have been appointed in the Department each year during the last three years. Before being appointed the Cadets are required to have such educational qualifications as will entitle them to proceed to the Diploma or Degree Course in Agricultural Science at the University. This is essential as the course of training prescribed for them requires that they take one or other of these courses.

Whilst receiving their academic training at the University, each Cadet is attached to one of the different branches of the Department so as to assist the officers connected therewith, and to become familiar with departmental routine. During the remainder of their period of cadetship, which is for four years, they are required to work on a farm or orchard, or in a butter factory, so as to acquire practical agricultural experience and outlook. On completion of their course they will be allocated to some particular branch, preferably one for which they have shown aptitude, in order to acquire the administrative experience in technical matters essential for a departmental specialist.

EDUCATIONAL CO-OPERATION.

Interested as the Department is in the distribution of technical agricultural information, co-operation is very desirable between it and other organisations similarly interested. It is therefore very gratifying to have active co-operation between it and the Education Department—which teaches elementary Agricultural Science in the primary schools, and adapts the curriculum in rural schools to the environment of the pupils—and with the W.A. University, and particularly with the Faculty of Agriculture, in which the Agricultural student can receive the crown to his scientific education.

Because of the very close co-operation which exists between the University and the Department, it has been possible to inaugurate two short instructional courses, both of which are held at the University. One, which is held during the summer months, deals with Rural Household Science, and was arranged to suit the needs of country women, though the attendance is not confined to them; the other, a Dairy Science Course, is held during the winter, and was arranged to provide technical training for factory managers, butter makers, milk and cream testers and graders. At the conclusion of the course a certificate is issued to those qualifying for it, and only holders of these certificates or their equivalent will be granted permanent certificates to test and grade milk and cream under the "Dairy Industry Act, 1923."

CONCLUSION.

In fulfilment of the spirit of scientific progress which called this Department into being it is still advancing the interests of agriculture. Each new problem occurring in the development of our rural areas is dealt with as it arises, the machinery of the Department being adapted, when necessary, to comply with altered conditions resulting therefrom. In consequence, the organisation of the Department is arranged to cover the divergent phases of farming which exist under the varying conditions obtaining in the vast area covered by the agricultural portions of the State, and the technical staff, in addition to their ordinary departmental duties, make personal visits to the different farming centres to advise on individual or community problems, give lectures, and conduct demonstrations and experiments. The farmers have thus at their disposal the services of the departmental specialists to assist them sympathetically in developing our agricultural resources. That these services are in great demand is not surprising, for the departmental "Spirit of Advancement" is the "Spirit of Service."

SCIENCE AND AGRICULTURE.

John W. Paterson, B.Sc., Ph.D.,
Professor of Agriculture.

In the past, farmers have frequently expressed distrust of agricultural education, and the benefits which science might afford. There is justification for this in so far as science alone will not make a farmer.

In almost any trade or profession practical experience forms the basis of competency. It is so with the doctor or engineer; it is so with the man on the land. Practical experience gives the necessary manual dexterity and an automatic aptitude in doing things; it also with most persons develops the sense of proportion.

But the doctor or engineer who had only his practical experience to rely upon would not inspire confidence. Cases out of the ordinary would find him doubting. Consequently he finds it necessary during his training to make a study of the pure sciences, and in particular the application of those sciences to problems arising in his profession. This abstract knowledge enables the practitioner to master fresh cases as they arise, and to know the reason for what he does.

The land offers to the farmer problems which are at least not less complex than those confronting the doctor or engineer. Ninety per cent. of a doctor's cases may be normal, but there are no normal cases in crop production. That highly complex mixture—the soil—varies from farm to farm and climate varies from year to year, so that strict rule-of-thumb methods become in special measure inapplicable. The farmer has to keep thinking all the time.

The greater his scientific knowledge and the deeper his insight into soil management, plant and animal nutrition, plant and animal diseases, and the hundred and one processes affecting crop yields, the more likely is he to be successful.

Farming in W.A., as we know it to-day, would be non-existent but for the help it has received and is receiving from science. It wants still more help.

All of us have a certain stock of scientific knowledge (including the professed doubters), and all of us have still a great deal to learn.

There is a ridiculous impression, more or less prevalent in all large cities, that the farmer's occupation makes no call upon his brains. Farmers have probably noticed and laughed at it.

There is no occupation, which if it is to be followed by the best results, requires a greater exercise of mechanical skill combined with technical knowledge than does that of the farmer.

All the civilised countries of the world are devoting yearly increasing attention to training in agricultural science. In the U.S.A. alone the annual appropriation for agricultural education, research, and rural extension lectures is equal to £12,000,000.

In W.A. during the statistical year ending February, 1922, the estimated value of production from all industries was £20,461,233. Of this total, the grouped farming industries produced 58 per cent.; other primary industries 24, and manufactures 18 per cent. It is claimed that further development of instruction in agricultural science has become a matter of national importance.

During the last eleven years a good deal of spade work has been done in paving the way for future developments. These activities extend from the primary school right up to the University. In considering school activities (primary and secondary) the view has prevailed that practical experience can best be obtained on the ordinary commercial farm, and that the school curriculum should be confined to theory with laboratory practice.

In rural primary schools a three-years' course chiefly of an experimentla nature, and reaching from the fourth to sixth standards, has been in operation for several years.

In the district high schools pupils are prepared for the Junior and Leaving Certificates of the University, the number of candidates sitting last November being 138.

The Narrogin Farm School takes about 60 boys of not less than fourteen for a two years' course, where work is divided between the farm and the class-room.

The University offers a degree (B.Sc. in Agriculture) after three years' attendance at classes to students who have already passed the University matriculation examination; it also offers a diploma in Agriculture after a two years' course to students who have passed a lower entrance examination. In each case students must spend at least twelve consecutive months upon an approved farm (if not already done) before entering upon the final year of classes. The number of new entries for the degree course this year is 16.

The Government have recently decided to establish an Agricultural College near a central position on the railway system. This will be a real encouragement, and should also provide facilities for research of which the University has always been in want. It is probable that when the College is established the diploma course at the University will be discontinued, but the longer degree course will be retained.

Six of this year's new entrants for the degree course are cadets appointed by the Department of Agriculture, and intended later to take up full duty in the Department. The remainder are private students, who later on may receive employment in this or other branch of the public service, with business houses having an agricultural connection, or in farming on their own account. In some of the Eastern States special concessions are granted by Government to agricultural graduates on taking up land. At the present time the prospects of clever lads taking up agricultural science are considered good.

In addition to the systematic courses in agricultural science at present in operation in the primary and secondary State schools and at the University, numerous single lectures by experts of the Department of Agriculture are given to farmers throughout the State, and tend to focus attention on the value of abstract knowledge. The reader will be familiar with this work. Parents attending such lectures should pause to consider the advantage to their farming sons of proceeding to some school or institution where a good foundation of scientific knowledge for the future may be laid.

It has been remarked in this brief article that interest in the application of science to agriculture is increasing. The welcome re-appearance of the *Journal of Agriculture* in its present form is a proof of it, and of the desire of the Department of Agriculture to keep abreast of the times.

THE DEVELOPMENT OF A DAIRY HERD.

P. G. HAMPSHIRE,
Dairy and Pig Expert.

In the development of a profitable herd there are a number of matters which must be taken into consideration. First of all in regard to the selection of animals to start the herd, next a decision as to the breed of bull to be used, and steadfastness of purpose in regard to a continuity of the breed with a view of systematic "grading up"; careful and enthusiastic management; proper attention to the feeding of the herd, not only from the point of view of sufficiency, but efficiency, namely, economy; this means the growing of foodstuffs on the farm to reduce to a minimum the purchase of costly "concentrated" foods and practically the elimination of the purchase of "roughages"; and finally a systematic recording of each cow's production by testing, with the elimination of the unprofitable low producers, and the rearing of heifers from the high producers, to become additions to the herd and take the place of the culls.

In the establishment of a profitable dairy herd, the principal factors of success may be summarised as follow:—Selection, Breeding, Management, Feeding, and Culling.

The dairyman's slogan should be "Breed, Feed, Weed." This motto should be always borne in mind.

The writer proposes in a series of articles in the *Journal of Agriculture* to cover these subjects, with the hope of helping dairy farmers—more particularly those who are embarking in the industry—on defined and proved lines of success towards the building up and improving of the herds of Western Australia in type, constitution, and production.

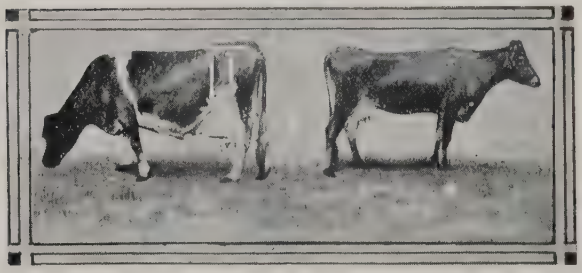
SELECTION.

In the selecting of females to start dairying, it would be better if one could start with heifers near to profit. In the first place, they are cheaper to purchase; they will settle down at their new home more quickly and with less trouble, and it is much easier to procure good quality heifers than to secure good cows, as, in the case of cows, owners are loth to dispose of good producers, and a man who is buying to build up a herd must of necessity, when purchasing cows, secure many culls. In many instances, of course, it will be impossible for prospective dairymen to buy heifers and wait until they come into profit. Such being the case, cows due to calve, or calved, must be secured.

In the development of a herd of, say, 40 cows, if the settler can wait and start with heifers he should follow somewhat these lines. Assuming that a herd of 40 cows is proposed to be kept, buy 25 two-year old springing heifers and 25 yearling heifers, culling out the inferior ones as they come into profit and so reducing the herd to 40 cows.

A HIGH-PRODUCING COW (Guernsey).

Showing desirable dairy points: Broad hips, fine tapering tail, flat thighs, large spacious "vessel" running well up behind, with teats of good size and well placed.



TYPES.

Desirable. *Undesirable.*

The deep-bodied, strong constitutioned, high producer, and the narrow-bodied, weak constitutioned, low producer.

In selecting heifers or cows, it should be understood that whilst certain dairy points are required and desirable it is almost impossible to judge from such points, with any degree of certainty, the true worth of an animal until the Babcock Tester and scales have been used to prove it. Time and again excellent judges have been deceived by appearances, but, nevertheless, profitable cows usually indicate certain dairy type which, to the trained and experienced eye, is displayed in the animal in a more or less marked degree. The first essential to ascertain in selection, is the quality of the sire of the animals and, if possible, their dams. This important matter will be dealt with under the heading of "Breeding." To the person who is not thoroughly experienced in the selection of dairy stock, a description of the desirable points should be studied.

The Desirable Points of a Cow.

No matter whether a cow is a pure bred, a grade, or a mongrel, points that indicate productiveness are as follow:—

Head.—Lean for preference, carrying no superfluous flesh.

Jaws.—Strong not undershot as with a pig, but square.

Nostrils.—Large and open.

Eyes.—Bright and lively with plenty of width between.

Horns.—Fine and oval at the base, tapering gradually, rather than round and thick and tapering sharply.

Neck and Shoulders.—Fine.

Back.—Strong, straight, and, when the cow is in milk, the joints should be discernible.

Hip Bones.—Wide with good length to pin bones, and comparatively level.

Tail.—Well set on and dropping straight down, being fine and tapering with a good brush.

Barrel.—Large and deep.

Ribs.—Well sprung.

Thighs.—Flat inside and out.

Flank.—Well arched and soft to handle.

Udder.—Good size distended, and freedom from fleshiness when empty, running well up behind and of good width between legs, and extended well forward along belly. (Most important to see a cow both full and empty to judge an udder.)

Teats.—Well placed, good size, and darkish in colour.

Milk Veins.—Large and tortuous.

Skin.—Soft to handle and loose. In rich testing cows, it is desirable that the skin inside the ears on the udder and at the tip of the tail should be a rich yellow colour; white or black skins undesirable.

Hair.—Generally should be soft.

Escutcheon.—The escutcheon which is indicated by the hair ascending from the udder upwards as against the other hair decending should, for preference, be wide, long, and free from "feathers."

Finally, a good dairy cow should conform to the three wedges of the dairy cow, namely—First wedge: From a point looking at the animal at broad side taking the top line from the shoulder to the tail, and the under line from the brisket to the udder. Second wedge: Looking along the back

from the hips to the top of the shoulder. Third wedge: Looking from the front from the top of the shoulder to a point through the heart.

Points that indicate Strong Constitution and Breeding Powers.

Jaws, nostrils, width through heart, width of hips and pin bones and length between, length and depth of barrel, strength of coupling, well sprung ribs, legs well placed, good carriage.

Points that indicate Quality and Vitality.

Fine horns of a close waxy texture; large prominent bright eyes; colour of skin in ears and all bald patches such as the nose, around the eyes, teats, and other parts; fineness and looseness of the skin and texture of the udder; fine tapering tail; fine bone; flat thighs.

Points that indicate Coarseness.

Thick open texture of horns; thick neck and shoulders, especially the latter; heavy tail with absence of tapering; coarse hair, thick tight skin; heavy bone, thick heavy thighs; heaviness about brisket and dewlap; fleshy udder and large bottle-shaped teats.

Points that indicate Weakness of Constitution.

Weak undershot pig-shaped jaws; small nostrils; narrowness through the heart; weak back and loins; want of depth of body; narrow hips and pin bones; flat sides; tight skin.

Points that indicate Deep Milkers.

Strong but not coarse head, with strong jaws and open nostrils; a deep barrel and well sprung ribs; well developed udder, free from fleshiness; large and tortuous milk veins; a first-class escutcheon.

Points that indicate Rich Milkers.

Colour of skin particularly in ears, all bald patches, udder and teats; fineness of hair; soft skin; colour and fineness of horns and hoofs.

SELECTION OF HEIFERS.

The quality of the sire and dam's production ancestry is of great importance. Heifers should be well grown according to age and have evidence of strong constitution with freedom from coarseness. A good depth of body is very desirable. The skin should be loose and soft to handle. Thighs should be flat with plenty of space between allowing for udder development running well up behind. Udder indication should be prominent and indicated by soft loose skin with teats well placed. Milk veins should be easily discernible.

SELECTION OF DAIRY SIRE.

Essentials.

1. Purity.
2. Production ancestry.
3. Type and dairy points.
4. Constitution.
5. Masculinity.

With regard to *Purity*, Herd Book registration is the only guarantee.

A GUERNSEY BULL.

A good dairy sire should show marked masculinity. Purity and Virility mean Prepotency.

A MODEL DAIRY COW.

Melba VII. (Milking Shorthorn). (The dam of the world's champion butter cow, Melba XV.)

THE THREE WEDGES OF THE DAIRY TYPE AND THE SQUARES OF THE COARSE, BEEFY ANIMAL.

Production Ancestry.—The production record of the dam and sire's dam should be good and, to be reliable, should be official.

An important point is the udder formation of the dam and sire's dam. A buyer of a bull should, if possible, ascertain for himself the type of udder which the dam of the bull has, as this will be an important factor in the animal's progeny. One often comes across a herd of cows in which the fore-quarters are very deficient. If a sire is mated to these cows whose dams were particularly good in the failing of the cows to be mated with, this fault will often be remedied in the progeny. On the other hand, if the mother of the bull and his other ancestry are deficient in this respect, the trouble is further accentuated.

Type means trueness of type to breed. *Dairy points* will be indicated by the quality of the skin both in thickness and looseness, the depth of body, well arched flank which is soft and loose to the touch and well split up behind, with thighs flat inside and out showing plenty of space between legs. Embryo teats and milk veins. In regard to the teats these should be prominent, but not necessarily large, more particularly should they be well placed, meaning a fair distance apart. Fineness of bone and tail is desirable, and colour of skin important.

Constitution will be indicated by the jaws, nostrils, width between the eyes, depth through the heart, strength of back and coupling—this being a most important point, depth of body well sprung ribs, strength and development of hind quarters, legs and feet well set on and squarely placed.

Masculinity will be indicated by the general air of virility, by carriage both standing and walking, and by the development of the generative organs.

Rather would I prefer to see a dairy sire indicating what may be called coarseness about the head and neck than weakness here, indicating effeminacy. The greater indications of masculinity the more prospect of imparting his high productive ancestry to his progeny.

HERD TESTING.

Production Results of all Registered Pure Cows under the W.A. Government Herd Testing Scheme to January, 1924.

P. G. Hampshire, H.D.C.,
Dairy and Pig Expert.

With the re-issue of the *Journal of Agriculture* advantage is taken to display the production records of all pure cows tested under the Herd Testing Scheme since its inception.

The accompanying table shows the result of each cow submitted to the test, including all those that failed to pass the standard.

RESULTS OF GOVERNMENT HERD-TESTING SCHEME.

Name of Cow.	Owner.	Breed and age at commencement of Test.	Herd Book Number.	Date of commencing Test.	Number of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required. (lbs. fat.)	Weight of Milk, last day of Test.	Remarks.
						lbs.	%	lbs.		lbs.	
Collingwoods Gladys	D. J. Goyder ...	Jersey (2 yrs. 3 mths.)	5,909	20-12-18	273	4,224	5·43	232·23	166	13½	
Brighton Queen III. of St. Lambert	do.	do. (2 yrs. 7 mths.)	5,292	20-12-18	273	4,719	5·01	240·18	166	7	
Retford Buttercup II.	do.	do. (2 yrs. 3 mths.)	6,830	11-5-19	273	4,059	6·56	266·50	166	11	
Jean of Dardanup	do.	do. (1 yr. 8 mths.	9,989	28-5-19	273	5,108	4·60	235·10	166	14½	
					365	8,751	5·18	453·50	166	17½	
Lyracleas Favourite	do.	do. (2 yrs. 4 mths.)	6,823	24-6-19	273	7,397	5·04	373·06		23½	
Lulu of Tellaraga	do.	do. (5 yrs. 5 mths.)	4,793	21-8-19	273	6,988	4·32	336·95	249	16½	
Island Cream of Roelands ...	do.	do. (2 yrs. 1 mth.)	6,822	28-9-19	273	5,417	5·89	319·48	166	15½	
Jean II. of Dardanup	R. H. Rose ...	do. (4 yrs.)	8,475	14-9-19	273	6,598	4·22	281·20	249	18	
Obligato	D. J. Goyder ...	do. (4 yrs. 4 mths.)	4,964	16-9-19	273	5,989	5·10	305·56	249	17½	
Lily II. of Dardanup	R. H. Rose ...	do. (2 yrs. 2 mths.)	8,946	28-12-19	273	5,599	5·22	292·47	166	24	
Daisy of Grassvale	do.	do. (3 yrs. 3 mths.)	8,473	31-12-19	273	4,822	5·36	258·55	207	17½	
Mokine Empire's Lily III. ...	T. H. Wilding ...	do. (8 yrs. 4 mths.)	10,049	4-11-19	273	6,206	5·75	357·35	249	16½	
Mokine Orange Lily	do.	do. (4 yrs. 3 mths.)	10,014	31-12-19	273	4,849	5·88	285·47	249	14	
Romany Maid of Tarnfirr ...	P. Rose	do. (2 yrs. 10 mths.)	6,036	29-4-20	273	5,274	5·48	289·39	207	11	
Yarraview, Handsome	A. W. Padbury ...	Guernsey (5 yrs 8 mths.)	394	17-6-20	273	4,658	4·82	224·74	249	5	Failed.
Maitland Zingara	D. J. Goyder ...	Jersey (6 yrs. 11 mths.)	3,086	16-4-20	273	6,334	5·15	325·98	249	10½	
Carnation of Dardanup... ...	R. H. Rose ...	do. (2 yrs. 4 mths.)	9,995	13-1-20	273	4,767	5·25	250·62	166	10	
Jessie of Dardanup	do.	do. (2 yrs. 7 mths.)	8,945	23-1-20	273	5,456	5·00	277·23	166	17	
Noreena of Tellaraga	D. J. Goyder ...	do. (2 yrs.)	6,823	25-4-20	273	4,753	5·19	246·61	166	7½	
Retford Violet	W. Padbury ...	do. (2 yrs. 11 mths.)	6,938	29-4-20	138	1,602	6·05	96·95	166	8½	Failed.
Pansy III. of Penryn	D. J. Goyder ...	do. (5 yrs. 11 mths.)	5,192	8-6-20	273	5,974	5·59	333·90	249	12	
Pretty Maid of Roelands ...	do.	do. (5 yrs. 11 mths.)	5,911	9-6-20	273	6,239	4·44	277·92	249	12	
Noreen 5th, of Banyule ...	W. Padbury ...	do. (2 yrs. 1 mth.)	7,125	17-6-20	273	3,644	5·64	205·51	166	11½	
Mokine Lady Guildford III. ...	T. H. Wilding ...	do. (5 yrs. 9 mths.)	10,634	18-6-20	273	5,366	5·92	317·89	249	8	
Jean of Dardanup	D. J. Goyder ...	do. (2 yrs. 9 mths.)	9,989	27-6-20	226	4,805	4·56	219·24	207	7	
Lydia 5th of Yaralla	do.	do. (2 yrs.)	6,826	1-7-20	273	4,392	4·84	212·92	166	7	
Beauty 3rd, Wangara of Pine Hill	R. H. Rose ...	do. (3 yrs. 9 mths.)	6,134	23-7-20	273	5,562	4·89	272·40	207	16	
Antimony's Elvira	T. L. Rose ...	do. (7 yrs. 10 mths.)	8,465	28-7-20	273	5,655	5·31	300·27	249	5	
Fancy of Ventonia	do.	do. (5 yrs 3 mths.)	8,468	2-8-20	203	4,461	5·10	227·63	249	8	Withdrawn
Luxe of Yarralla	D. J. Goyder ...	do. (3 yrs.)	6,825	4-8-20	273	6,599	4·65	306·96	207	23½	
Lily of Tarnfirr	do.	do. (9 yrs. 1 mth.)	2,221	16-8-20	146	4,234	4·02	170·35	249	18	Failed
Morden Lady V., of Waterville	A. W. Padbury ...	Guernsey (7 yrs. 10 mths.)	130	13-8-20	273	9,680	4·42	428·26	249	22½	
Yarraview Silver Susan ...	do.	do. (4 yrs. 1 mth.)	406	30-8-20	273	6,274	4·94	310·24	249	19	

Yarraview Isabel	do.	do. (3 yrs. 5 mths.)	397	29-12-20	273	4,929	5·15	254·21	207	16½	
Topsy of Grassvale	R. H. Rose ...	do. (6 yrs.)	10,101	19-8-20	273	6,205	5·51	348·63	249	16½	
Jean II. of Dardanup	do.	do. (4 yrs. 11 mths.)	8,475	30-8-20	225	4,612	4·59	211·69	249	8	Failed
Rhodesia 5th of Penryn ...	T. L. Rose ...	do. (4 yrs. 1 mth.)	8,470	7-9-20	227	5,492	4·37	240·27	249	8	Withdrawn
Lyracleas Favourite	D. J. Goyder ...	do. (3 yrs. 7 mths.)	6,823	11-9-20	273	7,173	5·24	376·18	207	16	
Wild Rose II. of Garden Hill ...	W. Padbury ...	do. (4 yrs. 1 mth.)	10,091	5-9-20	273	4,089	5·62	229·98	249	8½	Failed.
Retford Buttercup II.	D. J. Goyder ...	do. (3 yrs. 3 mths.)	6,830	19-9-20	273	4,856	6·08	295·37	207	11	
Obligato	do.	do. (5 yrs. 4 mths.)	4,964	30-9-20	252	4,911	4·59	225·52	249	10	Failed
Island Cream of Roelands ...	do.	do. (3 yrs. 2 mths.)	6,822	24-10-20	273	4,797	5·40	258·84	207	12	
Lady of Inglewood	do.	do. (4 yrs. 1 mth.)	5,910	10-10-20	190	3,100	5·43	168·35	249	11	Failed
Daisy of Grassvale	R. H. Rose ...	do. (4 yrs. 2 mths.)	8,473	14-11-20	273	4,687	5·69	266·94	249	13	
Roelands Queen of St. Lambert	D. J. Goyder ...	do. (1 yr. 10 mths.)	N.Y.A.	28-11-20	102	1,386	4·50	62·47	166	9	Failed
Carnation of Dardanup... ...	R. H. Rose ...	do. (3 yrs. 2 mths.)	9,995	29-11-20	273	4,930	5·20	256·47	207	12	
Jessie of Dardanup	do.	do. (3 yrs. 3 mths.)	8,945	6-12-20	273	5,056	4·83	244·36	207	17	
Lady Minta Gem	W. Padbury ...	do. (8 yrs. 7 mths.)	8,459	4-4-20	273	5,034	5·61	282·84	249	15	
Brightlass of Wollingurry ...	D. J. Goyder ...	do. (3 yrs. 9 mths.)	6,818	4-1-21	273	7,540	5·05	380·62	207	29	
Colleen Bawn	W. Padbury ...	do. (9 yrs. 2 mths.)	2,824	22-1-21	200	2,880	5·45	157·27	249	8	Failed
Yarraview Junket	A. W. Padbury ...	Guernsey (6 yrs.) ...	399	13-1-21	273	5,531	5·15	285·05	249	15	
Gaylass of Koojan	do.	do. (1 yr. 10 mths.)	630	30-1-21	273	4,502	5·68	255·91	166	15½	
Lily II. of Dardanup	R. H. Rose ...	Jersey (3 yrs. 5 mths.)	8,946	5-2-21	273	6,173	5·06	312·43	207	15½	
Lady Betty II. of Koojan ...	A. W. Padbury ...	Guernsey (3 yrs. 3 mths.)	N.Y.A.	25-3 21	273	6,542	4·47	292·88	207	18½	
Favourite of Roelands	D. J. Goyder ...	Jersey (1 yr. 9 mths.)	6,819	27-3-21	273	4,740	5·15	244·17	166	16	
Daisy 6th of Melrose	W. Padbury ...	do. (9 yrs. 5 mths.)	4,512	8-3-21	273	7,240	5·19	375·17	249	12½	
Lady Minta Gem	do.	do. (9 yrs. 7 mths.)	8,459	25-3-21	273	5,148	5·64	290·67	249	15	
Fondant 6th of Garden Hill ...	do.	do. (6 yrs. 9 mths.)	8,455	15-6-21	273	3,966	5·85	232·11	249	8	Failed
Fondant 9th of Garden Hill ...	do.	do. (3 yrs. 6 mths.)	8,456	28-3-21	273	4,727	5·61	265·31	207	13	
Yarraview Bonnie Annie ...	A. W. Padbury ...	Guernsey (3 yrs. 10 mths.)	504	17-4-21	273	6,665	6·27	418·20	207	20½	
Noraleda	D. J. Goyder ...	Jersey (6 yrs. 5 mths.)	4,794	21-4-21	273	6,546	4·77	312·19	249	7	
Noreena of Tellaraga	do.	do. (3 yrs.)	6,828	16-4-21	273	6,468	5·34	345·49	207	13½	
Carlotta of Ventrim	T. L. Rose ...	do. (7 yrs. 9 mths.)	8,467	20-4-21	273	5,939	5·36	318·29	207	8	
Magnolia III., of Southbridge ...	R. H. Rose ...	do. (3 yrs. 7 mths.)	7,287	26-5 21	273	3,755	6·24	234·52	207	9	
Maitland Zingara	D. J. Goyder ...	do. (8 yrs.)	3,086	29-5-21	273	7,092	4·99	353·32	249	8	
Jean of Dardanup	do.	do. (3 yrs. 9 mths.)	9,989	16-6-21	232	5,502	4·47	245·97	207	5½	
Fancy of Ventonia	T. L. Rose ...	do. (6 yrs. 1 mth.)	8,648	16-6-21	273	7,590	6·07	461·05	249	10	
Antimony's Elvira	do.	do. (8 yrs. 10 mths.)	8,465	25-6-21	273	7,313	5·36	391·91	249	11	
Lydia 5th of Yarralla	D. J. Goyder ...	do. (3 yrs.)	6,826	18-7-21	273	6,274	5·44	341·63	207	9½	
Veronica of Tarnfirr	do.	do. (5 yrs. 10 mths.)	5,174	16-7-21	232	6,330	4·65	294·29	249	8	
Noble Lass 2nd of Yaralla ...	do.	do. (3 yrs. 3 mths.)	6,825	26-7-21	252	4,989	5·39	268·93	207	5	
Rhodesia 5th of Penryn ...	T. L. Rose ...	do. (4 yrs. 11 mths.)	8,470	14-7-21	246	7,497	4·51	338·45	249	9½	
Jean 2nd of Dardanup ...	R. H. Rose ...	do. (5 yrs. 11 mths.)	8,475	9-8-21	241	6,035	4·33	261·73	249	5½	
Beauty 3rd Wangarra of Pine Hill	do.	do. (4 yrs. 10 mths.)	6,134	19-8-21	273	6,345	4·42	280·54	249	15½	
Milkmaid of Grassvale	do.	do. (2 yrs.) ...	8,472	13-8-21	273	4,422	4·78	211·62	166	6	
Maranora of Tellarraga ...	do.	do. (4 yrs. 5 mths.)	6,707	21-8-21	273	6,297	4·93	310·66	249	11	
Lyracleas Favourite	D. J. Goyder ...	do. (4 yrs. 6 mths.)	6,823	29-8-21	273	8,925	5·28	472·09	249	24½	
Fondant 3rd of Garden Hill ...	W. Padbury ...	do. (9 yrs. 11 mths.)	7,224	22-8-21	273	7,821	5·34	418·28	249	22	
Wild Rose 2nd of Garden Hill ...	do.	do. (5 yrs.)	10,091	13-8-21	273	5,519	5·70	314·78	249	16½	
Rhodora IV.	D. Malcolm ..	do. (6 yrs. 9 mths.)	4,763	29-8-21	243	6,447	5·27	339·95	249	12	
Madge of Dalebank	do.	do. (8 yrs. 3 mths.)	4,759	29-8-21	243	5,822	5·83	339·73	249	17	
Queen of Roelands	do.	do. (1 yr. 11 mths.)	6,829	29-8-21	273	5,273	4·87	256·67	166	18½	

RESULTS OF GOVERNMENT HERD-TESTING SCHEME—*continued*.

Name of Cow.	Owner.	Breed and Age at commencement of Test.	Herd Book Number.	Date of commencing Test.	Number of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)	Weight of Milk, last day of Test.	Remarks.
						lbs.	%	lbs.		lbs.	
Milton's Rosebud	A. W. Padbury ...	Guernsey (2 yrs. 9 mths.)	500	9-9-21	273	4,986	4·71	239·03	166	13½	
Obligato	D. J. Goyder ...	Jersey (6 yrs. 4 mths.)	4,964	4-9-21	273	6,168	4·79	295·45	249	5	
Milton's Syringa	A. W. Padbury ...	Guernsey (2 yrs. 4 mths.)	503	28-9-21	273	3,617	5·84	211·34	166	9	
Lady Fowler V. of Dardanup ...	T. L. Rose ...	Jersey (4 yrs. 1 mth.)	9,990	20 9-21	273	5,591	4·96	277·38	249	16	
Lady Mint's Gem II.	W. Padbury ...	do. (2 yrs. 6 mths.)	8,460	30-9-21	273	4,338	5·44	236·17	166	9½	
Jessimia 10th of King's Vale ...	D. Malcolm ...	do. (4 yrs. 4 mths.	6,338	29-9-21	152	3,466	4·38	151·83	249	10½	Withdrawn
Daisy of Grassvale	R. H. Rose ...	do. (5 yrs.) ...	8,473	10-9-21	273	5,529	5·66	313·13	249	10	
Jean of Grassvale	do.	do. (2 yrs.)	8,476	13-9-21	273	3,287	4·64	152·77	166	7½	Failed
Yarraview Glaydes	A. W. Padbury ...	Guernsey (2 yrs.) ...	783	3-10-21	273	3,005	5·77	208·18	166	7	
Morden Lady V. of Waterville	do.	do. (9 yrs.)	130	6-10-21	273	9,363	4·09	382·96	249	20	
Mayflower of Koogan	do.	do. (2 yrs. 7 mths.)	679	19-10-21	273	3,751	5·93	222·46	207	10	
Clematis of Glen Iris	W. Padbury ...	Jersey (3 yrs. 2 mths.)	7,108	5-10-21	214	2,934	5·74	168·61	207	8	Failed
Icecream of Glen Iris	do.	do. (3 yrs.) ...	7,110	13-10-21	273	4,000	5·31	212·48	166	10	
Rhodesia of Ventonia	T. L. Rose ...	do. (3 yrs. 2 mths.)	8,469	10-10-21	97	2,465	6·02	148·62	207	19½	Withdrawn
Lulumar of Tellarraga	R. H. Rose ...	do. (4 yrs. 2 mths.)	6,706	11-10-21	273	5,723	4·82	276·19	249	10½	
Jessie of Dardanup	do.	do. (4 yrs. 2 mths.)	8,945	12-11-21	273	5,141	4·87	250·42	249	8	
Creamy of Dardanup	do.	do. (4 yrs. 1 mth.)	8,941	21-11-21	257	4,816	5·64	271·61	249	12½	
Yarraview Silver Susan ...	A. W. Padbury ...	Guernsey (5 yrs. 4 mths.)	406	22-11-21	273	5,436	4·71	256·54	249	17	
Golden Gem of Dardanup ...	D. J. Goyder ...	Jersey (4 yrs. 1 mth.)	9,988	8-11-21	273	5,274	4·47	235·73	249	15	Failed
Lady of Inglewood	do.	do. (5 yrs. 2 mths.)	5,910	6-11-21	219	3,339	5·56	213·54	249	10½	Sold
Fairy of Dardanup	R. H. Rose ...	do. (3 yrs. 11 mths.)	8,942	20-12-21	273	7,655	4·46	342·08	207	30½	
Lady Fowler of Roelands ...	D. J. Goyder ...	do. (7 yrs. 4 mths.)	9,991	2-2-22	273	5,811	5·30	308·35	249	18⅜	
Brightlass of Wollingurry ...	do.	do. (4 yrs. 10 mths.)	6,818	8-2-22	273	7,846	5·58	438·36	249	23⅜	
Modest 2nd of Homeleigh ...	D. Malcolm ...	I.M.S. (2 yrs. 1 mth.)	Vol. 2	19-2-22	273	5,099	3·96	202·20	166	11	
Girlie of Sarnia	do.	Jersey (3 yrs. 5 mths.)	9,992	21-4-22	273	9,038	4·78	432·78	207	30	
					365	10,643	4·90	520·68		13½	
Yarraview Isabel	D. J. Goyder ...	Guernsey (4 yrs. 10 mths.)	397	5-4-22	273	5,197	4·76	247·58	249	15½	Failed.
Flavoria of Banyule	Dept. of Agriculture	Jersey (4 yrs. 2 mths.)	8,489	18-5-22	224	5,315	5·80	308·57	249	8	
Yarraview Georgina	A. W. Padbury ...	Guernsey (2 yrs. 6 mths.)	782	11-4-22	273	4,604	5·34	246·25	166	12	
May of Grassvale	R. H. Rose ...	Jersey (1 yr. 10 mths.)	9,997	17-4-22	273	3,839	5·34	205·07	166	13	
Jean 2nd of Grassvale	do.	do. (1 yr. 8 mths.)	9,996	19-4-22	273	4,329	5·90	255·43	166	14	
Twylish Madeira of Roelands ...	D. Malcolm ...	do. (2 yrs. 9 mths.)	6,832	29-4-22	273	3,918	5·90	231·23	166	6	
Lady Betty 2nd of Koogan ...	A. W. Padbury ...	Guernsey (4 yrs. 6 mths.)	N.Y.A.	23-4-22	273	5,717	4·65	266·14	249	11½	
Gay Lass of Koogan	do.	do. (3 yrs. 1 mth.)	630	25-4-22	273	4,516	6·15	277·19	207	10½	

Retford Buttercup 2nd ...	D. J. Goyder ...	Jersey (5 yrs. 3 mths.)	6,830	15–5–22	273	7,488	6·50	487·25	249	25½		
Mystery 20th of Melrose ...	D. Malcolm ...	do. (5 yrs.) ...	8,450	3–5–22	273	6,610	6·34	419·55	249	17		
Jessimia XI. of King's Vale ...	do. ...	do. (4 yrs. 11 mths.)	6,339	8–5–22	273	6,008	4·51	271·01	249	17		
Daisy of Garden Hill	W. Padbury ...	do. (2 yrs. 2 mths.)	10,628	20–5–22	273	3,597	6·06	218·02	166	9		
Yarraview Bonnie Annie ...	A. W. Padbury ...	Guernsey (4 yrs. 10 mths.)	564	31–5–22	273	6,189	6·33	392·01	249	15½		
Wisteria 2nd of Homeleigh ...	D. Malcolm ...	I.M.S. (2 yrs. 7 mths.)	Vol. 2	8–6 22	273	6,769	4·47	303·09	166	18		
Rhodora IV.	do.	Jersey (7 yrs. 7 mths.)	4,763	23–6–22	273	9,746	5·38	524·54	249	27		
					365	11,490	5·47	622·25		14		
Maranoa of Tellaraga	R. H. Rose ...	do. (5 yrs. 4 mths.)	6,707	5–7–22	273	9,081	4·74	430·40	249	17½		
Rhodora 2nd of Dalebank ...	D. Malcolm ...	do. (1 yr. 10 mths.)	8,451	10–7 22	273	5,111	5·82	297·52	166	9½		
Jean 2nd of Dardanup ...	R. H. Rose ...	do. (6 yrs. 10 mths.)	8,175	22–7–22	273	8,304	4·20	349·27	249	10½		
Fondant 6th of Garden Hill ...	W. Padbury ...	do. (7 yrs. 10 mths.)	8,455	21–7–22	273	4,484	5·81	260·60	249	9½		
Obligato	D. J. Goyder ...	do. (7 yrs. 3 mths.)	4,964	3–8 22	243	6,200	5·11	318·99	249	9½		
Lydia 5th of Yarralla	do. ...	do. (4 yrs. 1 mth.)	6,826	8–8–22	243	6,453	5·32	343·47	249	12½		
Madge 2nd of Dalebank ...	D. Malcolm ...	do. (1 yr. 11 mths.)	8,449	18 8 22	243	4,536	5·56	252·31	166	5		
Daisy of Grassvale	R. H. Rose ...	do. (5 yrs. 11 mths.)	8,473	29–8 22	273	7,690	5·37	413·56	249	19		
Lady Mint's Gem 3rd	W. Padbury ...	do. (3 yrs. 5 mths.)	8,460	28 8 22	243	3,539	5·41	192·15	207	6	Failed	
Noreen of Garden Hill ...	do.	do. (2 yrs. 2 mths.)	11,662	29–8 22	273	3,218	5·48	176·36	166	8		
Morden Lady of Koogan ...	A. W. Padbury ...	Guernsey (2 yrs.) ...	722	16–8 22	273	7,473	3·83	286·46	166	18½		
Shiela of Sarnia	D. Malcolm ...	Jersey (1 yr. 10 mths.)	8,452	31–8–22	273	6,178	5·70	352·40	166	17		
Milton's Rosebud	A. W. Padbury ...	Guernsey (3 yrs. 8 mths.)	500	1 9–22	273	6,048	4·27	258·25	207	10½		
Buttercup of Roelands	D. J. Goyder ...	Jersey (2 yrs.) ...	10,616	2 9–22	273	3,528	5·71	201·56	166	9		
Retford Wonder 2nd	D. Malcolm ...	do. (7 yrs. 10 mths.)	4,435	7–9–22	273	6,195	6·25	387·18	249	12½		
Noble Jessie IV. of Banvale ...	Dept. of Agriculture	do. (3 yrs. 9 mths.)	8,490	8–11–22	273	4,431	5·29	234·79	207	...		
Lily 3rd of Garden Hill ...	W. Padbury ...	do. (3 yrs. 3 mths.)	11,661	7–9 22	243	3,422	5·10	174·73	207	9	Failed	
Wild Rose 2nd of Garden Hill...	do.	do. (6 yrs. 1 mth.)	10,091	7–9–22	273	7,464	5·92	441·96	249	22		
Icecream of Glen Iris	do.	do. (3 yrs. 11 mths.)	7,110	9 9 22	273	4,674	5·48	256·21	207	13		
Lulu 2nd of Roelands	D. J. Goyder ...	do. (1 yr. 9 mths.)	10,614	16 9 22	273	4,531	4·77	216·52	166	9½		
Beauty 3rd, Wangara of Pine Hill	R. H. Rose ...	do. (5 yrs. 10 mths.)	6,134	12 9–22	273	6,885	4·37	300·84	249	14		
Queen of Roelands	D. Malcolm ...	do. (2 yrs. 11 mths.)	6,829	20–9 22	153	4,836	4·92	238·02	207	27		
Yarraview Glaydes	A. W. Padbury ...	Guernsey (2 yrs. 11 mths.)	783	15 9–22	273	5,022	5·01	251·76	207	12		
Milton's Syringa	do.	do. (3 yrs. 3 mths.)	503	19 9 22	273	4,095	5·69	233·07	207	10½		
Lux of Yarralla	D. J. Goyder ...	Jersey (5 yrs. 1 mth.)	6,825	20 9–22	273	8,376	4·61	386·76	249	20½		
Lydia of Roelands	do.	do. (2 yrs. 3 mths.)	11,431	20–9 22	273	4,566	4·94	225·99	166	9		
Cheerful 2nd of Yarralla ...	A. H. Heaume ...	do. (6 yrs. 7 mths.)	6,258	27–9–22	273	3,861	5·78	223·56	249	11	Failed	
Retford Tessie	W. Padbury ...	do. (3 yrs. 5 mths.)	8,464	27–9 22	273	3,577	5·91	211·42	207	12		
Jean of Grassvale	R. H. Rose ...	do. (3 yrs.)... ...	8,476	26–9–22	273	4,880	4·64	226·75	207	7		
Carnation of Dardanup... ...	do.	do. (5 yrs.)... ...	9,995	28–9–22	258	8,870	5·35	474·87	249	20		
Jessie of Dardanup	do.	do. (5 yrs.)	8,945	30–9–22	273	7,434	5·07	377·04	249	14		
Lyracleas Favourite	D. J. Goyder ...	do. (5 yrs. 7 mths.)	6,823	30–9–22	273	11,462	5·01	574·23	249	31		
					334	12,954	5·12	663·84		22½		
Clematis of Glenirls	W. Padbury ...	do. (3 yrs. 10 mths.)	7,108	1–10–22	273	6,042	5·91	357·16	249	14½		
Treasure 3rd of Homeleigh ...	D. Malcolm ...	M.S. (2 yrs. 11 mths.) ...	Vol. 2	2–10–22	273	8,805	4·34	382·87	166	23		
Golden Cream of Roelands ...	D. J. Goyder ...	Jersey (2 yrs. 1 mth.)	10,617	10–10–22	273	4,860	5·19	252·27	166	10½		
Boronia of Grassvale	R. H. Rose ...	do. (3 yrs. 2 mths.)	9,994	14–10–22	273	6,675	4·94	330·07	207	20		
Lily 2nd of Dardanup	do.	do. (5 yrs.)... ...	8,946	15–10–22	273	7,933	4·92	390·16	249	18½		
Creamy of Dardanup	do.	do. (5 yrs.) ...	8,941	30–10–22	273	6,197	4·99	309·44	249	16		
Silver Belle of Roelands ...	A. H. Heaume ...	do. (4 yrs. 8 mths.)	10,047	20–10–22	243	5,820	4·62	269·32	249	15		
Fondant 3rd of Garden Hill ...	W. Padbury ...	do. (11 yrs.) ...	7,224	24–10–22	273	9,037	5·52	499·64	249	27½		
Lady Fowler 2nd of Dardanup...	R. H. Rose ...	do. (7 yrs. 2 mths.)	10,003	12–11–22	273	6,252	4·65	290·63	249	17½		
Lady of Inglewood	D. Malcolm ...	do. (6 yrs. 2 mths.)	5,910	17–11–22	273	5,898	5·62	331·46	249	5		

RESULTS OF GOVERNMENT HERD-TESTING SCHEME—*continued.*

Name of Cow.	Owner.	Breed and Age at commencement of Test.	Herd Book Number.	Date of commencing Test.	Number of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required. (lbs. fat.)	Weight of Milk, last day of Test.	Remarks.
						lbs.	%	lbs.		lbs.	
Girlie 2nd of Sarnia	D. Malcolm ...	Jersey (1 yr. 11 mths.)	11,633	19–11–22	273	7,140	4·13	295·36	166	23	
Lily of Roelands	D. J. Goyder ...	do. (2 yrs. 3 mths.)	10,619	14–11–22	273	4,881	4·43	216·64	166	11	
Golden Gem of Dardanup ...	do.	do. (5 yrs. 1 mth.)	9,988	1–12–22	213	4,589	4·62	212·09	249	10½	Failed
Fairy of Dardanup	R. H. Rose ...	do. (4 yrs. 11 mths.)	8,942	15–12–22	273	8,305	4·75	395·05	249	27½	
Mamselle Mimi of Hamel Lea ...	A. H. Henning ...	do. (2 yrs. 9 mths.)	10,046	28–12–22	273	5,166	5·37	277·85	207	10½	
Lady of Moorlands	P. Rose	do. (4 yrs. 4 mths.)	8,938	6–1–23	273	4,644	4·74	220·14	249	11½	Failed
Brightlass of Wollingurry ...	D. J. Goyder ...	do. (5 yrs. 10 mths.)	6,818	4–2–23	273	11,289	4·93	556·74	249	28	
Lily of Grassvale	R. H. Rose ...	do. (2 yrs. 5 mths.)	8,947	7–2–23	273	7,482	5·00	374·63	166	30½	
Modest 2nd of Homeleigh ...	D. Malcolm ...	M.S. (3 yrs. 1 mth.) ...	Vol. 2	17–2–23	183	3,426	3·49	119·69	207	14½	Failed
Pet 8th of Glenira	do.	do. (1 yr. 9 mths.) ...	...	5–3–23	273	5,802	4·67	270·98	166	18½	
Retford Violet	W. Padbury ...	Jersey (5 yrs. 5 mths.)	6,938	14–3–23	273	6,528	5·78	348·08	249	15	
Favourite of Roelands	D. J. Goyder ...	do. (3 yrs. 9 mths.)	6,819	22–3–23	273	7,697	5·02	396·37	207	22½	
Morden Lady V. of Waterville...	A. W. Padbury ...	Guernsey (10 yrs. 5 mths.)	130	29–3–23	273	10,290	4·24	437·21	249	34	
Lady Fowler 12th of Dardanup	R. H. Rose ...	Jersey (2 yrs. 4 mths.)	10,011	29–3–23	273	6,970	4·75	332·25	166	24½	
Pride III. of Blackheath ...	Wooroloo Sanatorium	M.S. (2 yrs. 1 mth.) ...	N.Y.A.	11–4–23	273	7,049	3·73	263·52	166	21	
Milton's Daisy	A. W. Padbury ...	Guernsey (1 yr. 9 mths.)	N.Y.A.	5–4–23	273	5,515	5·47	278·37	166	20½	
Picton's Trequean Flirt, Mokine	do.	do. (2 yrs. 1 mth.)	747	20–4–23	273	5,566	4·74	264·20	166	22½	
Emp re's Lily VI.	T. H. Wilding ...	Jersey (2 yrs. 8 mths.)	10,636	11–5–23	273	6,120	6·19	380·57	166	20½	
Gladys of Roelands	D. J. Goyder ...	do. (3 yrs. 8 mths.)	6,821	15–5–23	273	5,763	5·53	318·93	207	10	
Daisy VI. of Melrose	W. Padbury ...	do. (11 yrs. 5 mths.)	4,512	21–5–23	273	10,605	5·18	550·05	249	33	
Wisteria 2nd of Homeleigh ...	D. Malcolm ...	I.M.S. (3 yrs. 5 mths.)	N.Y.A.	24–5–23	273	6,184	3·94	243·85	207	9	
Jean II. of Grassvale	R. H. Rose ...	Jersey (2 yrs. 9 mths.)	9,996	28–5–23	273	8,701	5·84	508·93	207	31	
Tiny of Grassvale	do.	do. (4 yrs. 2 mths.)	N.Y.A.	30–7–23	63	2,392	5·33	127·56	249	38½	Sold
Golden Bell of Roelands ...	A. H. Henning ...	do. (6 yrs. 7 mths.)	10,117	10–8–23	153	3,538	5·73	202·99	249	20½	Sold
Mamselle Mimi of Hamel ...	do.	do. (3 yrs. 7 mths.)	10,046	29–10–23	63	1,765	5·16	91·12	207	27½	Sold
Cocky of Claremont	Hospital for Insane	M.S. (10 yrs. 9 mths.)	N.Y.A.	29–5–23	273	10,296	4·02	414·25	249	28	
May of Blackheath	Wooroloo Sanatorium	do. (2 yrs. 7 mths.)	N.Y.A.	22–6–23	273	10,065	3·84	386·56	166	30½	
Maranora of Tellarraga	R. H. Rose ...	Jersey (6 yrs. 3 mths.)	6,707	30–5–23	273	10,533	5·05	531·90	249	27	
Dorinda 4th of Dardanup ...	P. Rose	do. (6 yrs. 7 mths.)	9,993	6–4–23	273	5,713	5·50	314·38	249	17	
Blossom of Moorlands	do.	do. (2 yrs. 5 mths.)	8,926	6–3–23	273	4,476	5·27	236·20	166	14½	
Lass of Moorlands	do.	do. (3 yrs.) ...	8,939	9–6–23	243	4,917	5·44	284·81	207	9	
Myrtle of Merridale	do.	do. (4 yrs. 8 mths.)	8,928	20–6–23	243	4,828	5·44	262·85	249	11½	
Overton Mary	W. G. Burgess ...	Ayrshire (13 yrs.) ...	2,601	22–5–23	273	7,994	4·38	350·51	249	15½	
Marge of Oakbank	do.	do. (6 yrs. 10 mths.)	6,161	13–6–23	243	6,043	4·41	266·52	249	4½	
Tipperary Mona	do.	do. (4 yrs. 3 mths.)	6,165	19–6–23	273	6,568	4·88	320·58	249	10	
Fuchsia of Gleneira	do.	do. (2 yrs. 10 mths.)	8,514	20–6–23	273	6,813	4·52	307·89	166	11	
Quality of Oakbank	do.	do. (5 yrs. 8 mths.)	6,163	21–6–23	273	7,042	3·70	260·87	249	12½	
Winifred of Oakbank	do.	do. (6 yrs. 10 mths.)	6,167	4–7–23	273	8,475	4·02	341·07	249	8½	

MR. D. J. GOYDER'S JERSEY COW, "LYRACLEAS FAVOURITE," Reg. No. 6823.

Western Australia's High Producer: 12,954 lbs. milk, 663.8 lbs. fat in 334 days.

Outstanding Results in the various Classes.

Heifers on First Calf.

—	No. Days in Test.	Milk.	Average Test.	Butter Fat.	—
		lbs.		lbs.	
May of Blackheath ...	273	10,065	3·84	386·56	Milking Shorthorn (Wooroloo Sanatorium.)
Treasure III. of Homeleigh ...	273	8,805	4·34	382·87	Milking Shorthorn (D. Malcolm).
Mokine Empire's Lily VI.	273	6,120	6·19	380·57	Jersey (T. H. Wilding).
Lyracleas Favourite ...	273	7,397	5·04	373·06	Jersey (D. J. Goyder).
	365	8,751	5·18	453·50	
Lily of Grass Vale ...	273	7,482	5·00	374·63	Jersey (R. H. Rose).

Cows 3 years and under 4 years.

Jean II. of Grass Vale	273	8,701	5·84	508·93	Jersey (R. H. Rose).
Girlie of Sarnia ...	273	9,038	4·78	432·78	Jersey (D. Malcolm).
	365	10,643	4·90	520·68	
Yarraview Bonnie Annie	273	6,665	6·27	418·20	Guernsey (A. Padbury).

Mature Cows.

Lyracleas Favourite ...	273	11,462	5·01	574·23	Jersey (D. J. Goyder).
	334	12,954	5·12	663·84	
Brightlass of Wollingurry	273	11,289	4·93	556·74	Jersey (D. J. Goyder).
Daisy VI. of Melrose ...	273	10,605	5·18	550·05	Jersey (W. Padbury).
Maranora of Tellaraga	273	10,533	5·05	531·90	Jersey (R. H. Rose).
Rhodora IV.	273	9,746	5·38	524·54	Jersey (D. Malcolm).
	365	11,400	5·47	622·25	

Average production in each class and *all* cows, including failures—

—	Milk.	Average.	Butter Fat.
	lbs.	Test.	lbs.
Heifers on first calf	5,076	4·99	253·43
Cows 3 years and under 4 years	5,288	5·18	274·19
Mature Cows	6,410	5·06	324·69
Average of all Classes all cows, including failures, those sold or withdrawn	**5,721**	**5·07**	**290·81**

The object of Purebreds Herd Testing is to provide authentic information regarding the production of cows to enable the dairy farmers of this State to select young bulls of guaranteed purity and known production to head the herds with a view of improving the type and production of their future herds.

In cases where dairymen require financial assistance the Government has arranged to give settlers the opportunity of acquiring such young bulls on three years' terms of repayment. In all cases these bulls will be registered pure *ex* dams with production above standard.

The price of such bulls will range from £20 to £40, the price being in accordance with the high production of the dam.

PASTURES IN THE SOUTH-WEST.

A. B. Adams, Dipl. Agr.,
Agricultural Adviser, Dairy Branch.

In most countries of the world that are situated in a temperate climate with a rainfall of 30 inches or over, pastures give the best labour income of all crops, excluding perhaps a few special crops and exceptional seasons. With a high market price for his produce the arable farmer may be in a better financial position, but with a downward trend in prices the farmer who has a big percentage of good sound grass in his holding is the one who weathers the bad times with the least strain.

In the past the amount of attention desirable has not been given to the improvement of pastures, mainly for the following reasons:—

(1.) The first settlers had a big area on which to run their stock and made a practice of periodically moving their stock from the timber to the coast and *vice versa*. Not being pushed for pasture, they applied their energies to growing crops for hay and grain, planting orchards, potato growing, etc.

(2.) Most of our soils are deficient in phosphoric acid, and as good pastures cannot be obtained if the soil is poor in this essential plant food, and in the absence of the present knowledge *re* top-dressing, it was considered extremely difficult to get a good pasture.

(3.) The summer is a long dry one, and the settlers may have thought that even if a pasture were established, it would not last long enough to be of much practical use.

(4.) The cost of clearing the forest country is heavy, if all the timber is removed.

The conditions of (1) no longer apply to the majority, the average settler having to rely on the foodstuffs he can grow within the boundaries of his holding.

In respect to (2) we now know that the application of phosphoric acid in some form as a top-dressing not only increases the bulk of the pasture crop but makes the growth start earlier, last longer, and gives healthier and more nutritious pastures and thus at least double the stock can be carried.

In the longer settled portions of the South-West much of the land that is almost cleared or that is carrying only dead timber is found on close examination to be full of annual clovers. Generally the plants are very small and feeble; sometimes it is almost necessary to use a magnifying glass to see them. Nevertheless, the plants are there and the application of 1 cwt. to 1½ cwt. of superphosphate per acre as a top-dressing will at once largely increase the stock-carrying capacity of the land.

Those settlers who have this class of country would be well advised to top dress it, introducing other suitable clovers and grasses from time to time as they can manage it. Experience has shown that top-dressing pastures give a better return financially than most of the farmers' efforts, and is one of the best and surest ways of building up a soil.

As to (3), many do not realise that our long dry summer is more than counterbalanced by the long cold winter of northern climates. The farmer in those cold countries, is compelled to conserve the whole of his forage requirements for the winter and early spring months, while our apparently dry pastures often give a good picking of nutritious food.

Our last reason (4) is perhaps the greatest factor why comparatively so little has been done in the way of laying down pastures. We now know that it is not necessary to go to the expense of total clearing to get pasture. On much of the green forest country ringing the timber followed up when this is dead by cutting the suckers and scrub and firing in late summer, leaves the land in good condition for sowing the seed. It must be remembered that it is of little use sowing seed unless suitable varieties are used and the land is top-dressed the first season and preferably for at least the next three or four seasons. Also the suckers and scrub must be kept down. Where the timber is dead and the land is consolidated with the treading of stock, or where there is not sufficient undergrowth, etc., to leave a good bed of ashes after a fire, the land should be worked up with spring tooth or disc cultivators to form a seedbed.

Where ploughing is possible at not too great a cost, a crop of oats may be sown and the grass seed sown on the harrowed land to grow with the oats. It is advisable to feed off the oats rather than to leave for hay or grain, otherwise the grass will suffer. A good time to feed off is when the soil is moist but is not wet enough to puddle. Sheep in the sheep districts are good for feeding off because they tread evenly and their droppings are well distributed. Young and small cattle are also better for this purpose than heavy cattle or horses.

For the new settler it is sound policy to clear off as little timber as possible in the first instance, so that (a) he may get in a good big area of pasture at the start and (b) that the cost of clearing may be spread over a longer period.

By an intelligent selection of grasses for the different classes of soil in the district, the grazing period can be extended considerably.

When sowing a pasture on any soil, it is advisable to have a mixture rather than any single variety, because:—

(a) Different varieties are at their best at different periods, therefore the grazing is near its best for a longer time.

(b) If the season or soil proves unsuitable to one variety it may suit another.

(c) Some plants are deep, some shallow rooted, giving a different feeding area for the plants, enabling them to stand closer on the ground without suffering from competition.

(d) Different varieties vary in their plant food requirements. The true grasses require their nitrogen in some compound of nitric acid and the clovers are able to get their nitrogen from the atmosphere.

(e) A mixed diet is always better for stock than an exclusive diet of one kind. As an example, it will be noticed that animals with nothing but Subterranean Clover will eat bracken fern for a change.

Taking their moisture content as a guide, our soils can roughly be divided into three classes:—

(1.) Dry soils that are never really wet in the winter and soon dry out when the rain ceases.

(2.) Swamps that are under water in the winter and though remaining moist are dry enough to carry stock in the summer time.

(3.) Country that is between the above two, *i.e.*, is wet but not under water in the winter and holds moisture till towards the end of summer.

(1.) The drier soils:—

For these, the annual clovers that will re-seed themselves every year are the most suitable and permanent. Of these Subterranean Clover and Cluster Clover (*Trifolium glomeratum*) are probably the best; Giblett's grass (*Lotus angustissimus*) and Boyd's Clover (*Lotus hispidus*) are also well worthy of a trial as, though later, they keep green longer than either of the other two, particularly if well eaten down. Boyd's Clover seed can be purchased but the seed of Giblett's Grass is not on the local market. Of the two grasses, there is only one other than Couch that is at all likely to do and that is Danthonia or Wallaby Grass; varieties of it are found growing through the South-West and along the Great Southern. Unfortunately, it is easily killed by cultivation and is slow to re-establish itself. It will stand fires and land stocking and is green with the first showers of rain. *Danthonia pilosa* and *Danthonia semiannularis* are listed by seedsmen, but the writer has been given to understand that these are only very slightly different varieties of the one grass and are now reclassified by botanists under the one name.

(2.) Wet Swamps:—

Water Couch (*Paspalum distichum*) is the only true grass that one can be certain will thrive if submerged for a long time. Of the legumes, Greater Birdsfoot Trefoil (*Lotus major*) and Strawberry Clover (*Trifolium fragiferum*) will both grow in swampy conditions and can be grown from seed or roots. Water Couch can be most conveniently grown from roots and is best planted in the spring. If planted during the cold weather, particularly if small cuttings are used, it may die out. Reversed or Drooping-flowered Clover (*Trifolium cernuum*) will stand a lot of wet but the seed is not quoted; it is really most suitable for land that is very wet up to about Christmas and then dries out very rapidly.

(3.) For the other type of country, Paspalum Dilatatum and Kikuyu will give a lot of good feed. On moist black sands overlying a clay subsoil Creeping Bent Grass (*Agrostis stolonifera*) is very permanent, but needs to be kept eaten down. If it becomes too old and coarse, it is not relished by stock. Of the legumes, on some soils White Dutch Clover does well and is very permanent, in other cases it dies out; it is always worth while including some of the seed in a mixture for the moist country. If on the wet side, Lotus Major and Strawberry Clover will be a good addition, but if inclined to be dry *Trifolium cernuum*, Giblett's grass, and Boyd's Clover will be more permanent than either of the other three.

There are many other grasses and clovers which will do well for a year or two, but under pioneer conditions tend to die out; with subdivision into small paddocks and judicious grazing they would no doubt last much longer.

The amount of seed to sow per acre will vary somewhat with the soil, etc., but where the annual clovers chiefly are grown the most economical way for the beginner is to sow rather thinly and give the plants a chance to seed the first season. After the second season the farmer should be able to save his own seed as these clovers are very prolific seeders. Two pounds of Subterranean Clover, one pound each of Cluster Clover, Gibblett's Grass, and Boyd's Clover, or two pounds of White Dutch or Lotus Major and three pounds of *Paspalum dilatatum* per acre would be about right.

Plants of Water Couch, Kikuyu, Lotus Major or Strawberry Clover may be planted 2ft. or 3ft. apart each way, or ploughed in at every other furrow.

A not impossible ideal for a stock farmer with varied country would be to carry his stock on pasture for eight or nine months and for the balance of the year on crops grown on his cultivated paddocks, either as green feed, silage, or hay, and on meadow hay cut from an unstocked grass paddock when the majority of the grasses are in flower.

The point to be impressed is that the soundest way of improving the carrying capacity is on grass supplemented by cultivation rather than on cultivation with grass as a side line.

AN INTENSIVE LUCERNE PLOT.

Geo. L. Sutton,
Director of Agriculture.

Prolific, Vigorous, Clean, and Healthy. This is the description which most correctly described the impression immediately formed on seeing the lucerne plot of Mr. A. C. R. Loaring established adjacent to his orchard at "Lawnbrook," in the hills at Bickley. Inquiry regarding the results obtained confirmed the impression originally formed.

The plot is only a small one. It is 26 yards wide and 52 yards long, just slightly over ¼ acre in area. It is irrigated through sprinklers from a brook on a higher level. Three thorough waterings are given to the plot each year, usually in January, February, and March. The lucerne is usually cut in sections in succession, and furnishes a supply of green fodder throughout the year. From December to April, inclusive, it is cut on an average once in three weeks, and from May to November about four cuttings are secured. When the whole plot has been cut at one time, 10cwt. of lucerne hay were obtained, from which is may be estimated that the total yield of green stuff ranges between 40 and 50 tons per year. The plot as it appeared on 21st February is shown in the illustration herewith, and its appearance justifies this estimate.

The seed bed, in accordance with Mr. Loaring's usual careful methods, was thoroughly prepared by digging, and the seed was sown in rows two feet nine inches apart. This is a novel method and has several distinct advantages. It enables the land between the rows to be kept loose by cultivation, as a result of which loss of soil moisture by evaporation is reduced to a minimum, and the water is conserved for the use of the crop. Another advantage is that the cultivation given to conserve the moisture also destroys weeds, thus preventing the crop from being robbed of that plant food and moisture which the weeds would use for their growth. Realising these advantages, the plot at "Lawnbrook" has been kept beautifully clean by the use of the Dutch hoe and horse cultivator. A saving of seed is effected when planted in this way. Assuming that only 50 per cent. of plants were obtained from the seed planted, 2lbs. of seed will provide 15 plants for every foot of row.

The plot has been most generously manured. During the first four years lime was applied at the rate of one ton per acre, as well as bonedust at the same rate; during the following two years superphosphate at the rate of half-a-ton and lime one and a-half tons per acre were applied; but during the last year it has received neither fertiliser nor lime.

The lucerne plant is a heavy feeder and responds to liberal manuring, as the results obtained from this plot show. It is probable, however, that one ton of lime every three years would have been sufficient to keep the soil in a friable and sweet condition. Assuming that the crop yield has been at the rate of 40 tons of green forage per acre, the crop removed each year would contain about—690lbs. nitrogen, 120lbs. phosphoric acid, and 500lbs. potash.

The yearly application of one ton of bonedust per acre would supply about 60lbs. of nitrogen and about 400lbs. phosphoric acid, while the half-ton of superphosphate would supply about 200lbs. of phosphoric acid. It will therefore be seen that these apparently liberal dressings of fertilisers were only liberal in respect of one of the essential constituents of plant food, viz., phosphoric acid, and of this they supplied a superabundance. Neither fertiliser supplied any potash, and even the quantity of nitrogen supplied by the bonedust was less than one-tenth necessary for the crop needs. Fortunately, except during the period immediately following germination, the lucerne plant is not usually dependent upon the soil nitrogen for its supplies. Being a legume it can, when suitable bacteria are present, obtain all its requirements in this connection from the inexhaustible supply contained in the air. The potash requirements of the crops have been obtained from the stores in the soil and subsoil of this red soil, and this has been facilitated by the application of lime, which has helped to make available the dormant supplies. This is obviously not possible when dormant supplies do not exist, as is the case in sandy soils, and in that case potash manuring is essential to ensure successful crops of lucerne. Just how long crops will be obtained at "Lawnbrook" without potash manuring can only be determined by experience. In the absence of other recognised cause, any loss of vigor should, however, be regarded as an indication of the need for an application of potash.

Having regard to the fact that lucerne once established does not need nitrogen to be supplied in fertilisers, the use of bonedust is an unnecessary expense. The phosphoric acid which should be supplied can be furnished much more cheaply by means of superphosphate. As an indication, basing calculations on present rates, the quantity of phosphoric acid supplied by superphosphate costing £5 15s. per ton would cost £12 18s. if supplied by bonedust.

AN INTENSIVE LUCERNE PLOT.

Having due regard to all the facts connected with the fertilisation of lucerne in addition to an application of one ton mild lime per acre, it is considered that on sandy soils a good preparatory fertiliser would consist of 100lbs. sulphate ammonia, 400lbs. superphosphate, and 400lbs. sulphate potash.

On heavy soils the amount of sulphate of potash may be considerably reduced, or even eliminated, without much risk of reducing the yields of crops in the early years. Subsequent applications of fertilisers should be governed largely by the returns aimed at or secured, say 14lbs. superphosphate and 25lbs sulphate potash for every ton of greenstuff. If the yield is as high as that obtained by Mr. Loaring, and the grower intends to replace what the crop has removed, the requirement will be from 500 to 600 lbs. of superphosphate and 900 to 1,000 lbs. of sulphate of muriate of potash.

The lucerne crop is so valuable that when irrigation facilities are available, heavy fertilising will invariably prove profitable. Lucerne is rich in protein, a food constituent essential for young animals, milking cows and laying hens, and usually not in sufficient supply in many of the most commonly grown fodders. Bran and pollard are frequently used to make up the deficiency. As 30lbs. of green lucerne contains about the same quantity of digestible protein as 10lbs. (half-a-bushel) of bran, it can therefore take the place of bran in the ration.

There are many places amongst the hills and elsewhere where irrigation on a small scale can be practised, and Mr. Loaring has shown by the splendid results obtained from his intensive plot how valuable such can be made by thorough cultivation and liberal fertilisation. This should encourage those with irrigation facilities to emulate him and secure equally good results.

FRUIT EXPORT.

Geo. W. Wickens,
Officer in Charge of Fruit Industries.

"Their apples are the best in Australia, the best packed and graded."

The quotation with which I have headed this article is taken from a report of the proceedings of a Conference of Entomologists held in the Eastern States last year, and it was expressed by Mr. George Quinn, who is Head of the Fruit Branch in the Department of Agriculture, South Australia, when referring to apples produced in Western Australia. There are many occasions when the gift of seeing ourselves as others see us, which Bobbie Burns thought so desirable, gives rise to reflections quite other than pleasant, but I must confess it was with unalloyed satisfaction that I read the above statement, and I have taken this opportunity of reproducing it so that our growers may feel heartened in carrying on the good work and living up to the reputation they have made for quality, both in Australian and Over-seas markets.

One can write with cheerfulness on the Apple Export Season of 1924, so far as it has proceeded to date in this State, but I am penning these notes on the 15th March, before any of our shipments have landed in England, and before the crucial test of prices received over costs disbursed has been applied. However, if we can form our expectations of probable returns on the number of agents who are desirous of purchasing apples for shipment to London, then the outlook is certainly bright, for I have never before known in nearly 25 years' experience of the Fruit Industry in this State so many firms anxious to buy. Not only are the local firms operating, but inquiries are frequently coming to hand from Eastern States' buyers, and whatever disappointments may lie in the future, it is quite evident that present expectations of a good English market rank high.

After last year's experience of low prices—many quite unprofitable both at home and abroad—the apple growers are badly in need of favourable sales this year, and if, as seems likely, the price of late apples on the local market reaches a high figure, I hope those who have to pay will not think the growers are making fortunes at the expense of the consuming public, but will realise that the man on the land would not be able to stay there if the seasons of low returns were not balanced to some extent by seasons when prices are high.

It is now over 20 years since small experimental lots of fruit, mostly apples, were first shipped to London from Western Australia, but in those earlier times the local market could absorb more than was produced in the State, and it was not until later years there was an absolute necessity to export a portion of the crop to overseas markets.

In 1912 we exported 65,205 cases of fruit and in 1923 407,085 cases, these figures being exclusive of shipments sent to the Eastern States. I am quite in accord with those who affirm much greater quantities of fruit would be consumed within the State if the means of distribution were improved, and the genuinely earnest attempt towards co-operating for this purpose now being made by some of the growers will certainly show good results if persisted in; but even allowing for increased local consumption the area under orchards and vineyards, which is once again on the increase, precludes the possibility of disposing of the whole crop within the State at prices remunerative to growers, and export is absolutely essential to the stability of the industry.

There are 24,245 acres devoted to fruit production within the State, and the largest areas are under kinds which can be, and are being, sent to over-seas markets. I refer to apples 10,063 acres, grapes 4,840 acres, oranges 3,213 acres, and pears 1,341 acres, which amount to slightly more than four-fifths of the total.

In this article I am confining myself mainly to notes on apple and pear shipments taking place this season, and will deal with grape and orange export in a subsequent issue. Last year, which was a season of abundant crops, we produced 758,998 bushels of apples and 106,827 bushels of pears; and exported 355,850 bushels of apples and 15,280 bushels of pears. This year the pear crop is so small that only small quantities of that fruit will be shipped, but space for apples, pears, and grapes has been booked to the extent of approximately 270,000 bushels. The quantities of each kind of fruit which will be shipped is not yet (15/3/24) definitely known, but the major portion will comprise apples; the crop of these is not so heavy

as last year, but I estimate it will approximate 500,000 bushels. In the present programme there are 10 boats to load fruit at Fremantle, four at Albany, and two at Bunbury.

I have personally examined a good deal of the fruit which has been sent forward for shipment by the earlier boats, and I congratulate growers on the general excellence, both of the fruit and packing. Instances there certainly are of inferior fruit coming to hand, some of which had to be refused permission to ship, but these are exceptions, and very few at that, the bulk of the fruit being of fine quality. The new grading regulations have bothered many growers, as is evidenced by the branding, but I am positive this in nearly every instance has been due to a lack of knowledge of the regulations, for as the season advances less mistakes are being made. A common error has been the too frequent use of the word "Special," and many hundreds of cases have had to be re-branded from "Special" to "Standard." It does not seem to have been sufficiently well known that colour must be taken into account in special grade apples, for it is laid down "they shall be of good colour for the variety," and many cases of Jonathans for the early boats had to be rebranded for this reason.

Another provision of the regulations deals with the size of apples branded "Special" or "Standard," and lays down that in neither of these grades can the apples be under 2¼in. in diameter, unless in "Standard" grade only the variety is one which, in the opinion of the Collector, may be regarded as normally small.

Many cases of Jonathans have come forward branded "2in. Standard," and a few even "2in. Special," and as Jonathan is not a normally small apple these had all to be rebranded "Plain." As a matter of fact none of the varieties usually shipped from this State to London can be described as normally small. Jonathans, Dunn's, Cleos, Granny Smith, Delicious, Gravenstein, Shepherds, are not normally small apples, and if they are under 2¼in. in diameter they must be described as "Plain."

I am sorry to record that we had to refuse permission to ship some cases —not many, fortunately—on account of Bitter Pit, and I wish to warn growers at all times to take every care to prevent pitted specimens from being packed for export. If Pit is only slightly in evidence at the time of shipment it may easily show badly when the fruit arrives in London, and a few pitted specimens in each case would prejudice the sale of a big consignment.

Proposals for the establishment of a subsidised shipping service between Australia and China for the purpose of developing trade will be submitted by a deputation which will wait on the Federal Treasurer (Dr. Page) and the Minister for Customs (Mr. Chapman) shortly. It is understood that a shipping company has offered to establish a service of steamers between Australia and China, running at intervals of six weeks, provided that the Commonwealth pays a subsidy. Some time ago it was announced on behalf of the Commonwealth that it was prepared to pay a subsidy, and a sum of £120,000 was mentioned. While the amount of the subsidy with which the shipping company desires to maintain the service between Australia and China has not been discussed, it is stated that it is very much below this figure.

HORTICULTURAL AND VITICULTURAL NOTES.

GEO. W. WICKENS,
Officer in Charge of Fruit Industries.

Seasonable Work for April, May and June.

APRIL.

With five boats—three at Fremantle, one at Albany, and one at Bunbury —taking fruit this month for English markets, apple growers will have most of their time occupied in packing for export, and gathering for storage the later ripening varieties, but just as there can be no harvest without seeding, so will no profitable fruit crop materialise unless the land receives proper cultivation, manuring and drainage, and the apple growers equally with those who are producing other kinds of fruit, must find time to carry out in each month the work which becomes necessary as the season advances.

Where the land requires lime apply it early in this month or end of March. A useful dressing is comprised of half a ton burned lime, or one ton of ground limestone per acre.

Sow 1½ bushels of peas with 2cwt. super. per acre early this month for ploughing under next spring.

Where underground drainage has not been provided use plough furrows as surface drains to prevent water logging, but do not use open furrows on steep slopes or washaways will occur.

Those who intend planting out new orchards or vineyards should have the land thoroughly prepared this month. Plough deeply 10in. to 12in. with a single furrow disc plough, or use a subsoiler. Remove all roots of native trees from the land.

In districts where fruit fly exists every care must be taken this month to collect all second crop deciduous fruits which, owing to having no commercial value, are often allowed to remain on the trees, become infested and carry on the pest to the orange crop. All fallen fruits should be collected, and those of no value destroyed by boiling.

With the mild weather of April Woolly Aphis usually increases rapidly, and often seriously injures the fruit buds which should produce the following season's fruit. Spray this month with Black Leaf 40 and soap, using Black Leaf 40 at the rate of 1lb. with soap at the rate of 3lbs. in 80 gallons of water.

MAY.

Pruning commences this month; stone fruits being the first to lose their leaves should be the first to receive attention, with the exception of shy bearing varieties of peaches, such as Briggs, Hales, and Alexander, which give better results if pruning is put off until Spring, when the trees are in bloom.

Where San Josè scale is present, spray this month after leaves have fallen with Commercial Lime Sulphur, 1 gallon lime sulphur to 10 gallons water. If Woolly Aphis is present add 2ozs. Back Leaf 40 to every 10 gallons lime sulphur mixture. Two sprayings should be applied to San Josè infected trees during the dormant period: the first at the commencement of winter, the second towards the end.

In districts where the rainfall is not heavy during winter, and finishes early in the spring, citrus trees may be planted out during this month, but in most districts where citrus fruits are being grown in this State it is best to wait until the heavy winter rains are over, and plant in September.

JUNE.

Pruning of vines and deciduous trees should be in full swing during this month.

Planting, both vines and deciduous trees, can be carried out wherever the soil is not too wet and sticky.

When the young plants are received from the nursery they should be attended to at once, and not left in bundles causing the roots to dry out and the tops to wither. The bundles should be opened, the plants separated and heeled in carefully, so that the roots are covered with firmly packed soil. If treated in this way as soon as they arrive no damage will result if the young trees or vines have to remain a few weeks before being planted out.

Where underground drains exist the outlets should be examined after heavy rain to ascertain if the drains are acting. If no water is issuing the pipes are probably blocked, and the obstruction should be searched for and removed.

Where the trees have not received the first spraying for San Josè scale, mentioned in operation for May, they should be attended to as early as possible in June.

Citrus growers must watch this month for appearance of Fruit Fly in cracked oranges, and as rain will prevent leaf baiting from being effective, fruit fly traps should be used and carefully and regularly cleansed of dead leaves or other debris. Mixture for traps is as follows:—4lbs. of pollard, 4ozs. molasses, 5ozs. paste arsenate of lead, or 2½ozs. dry arsenate of lead, 8ozs. powdered borax, and sufficient water to make up to 4 gallons (kerosene tin full).

Oranges will be exported to England during this month, and it is to be hoped the rainfall will not be as continuous as last year, when in many districts it was impossible to gather fruit during June in a dry condition. If possible, the fruit should be dry at picking and sweated for ten days before packing.

WOOLLY APHIS PARASITE.

Aphelinus mali (Hald).

L. J. NEWMAN, F.E.S.,
Government Economic Entomologist.

This new parasite has been successfully introduced into Western Australia.

The Woolly Aphis (*Schizoneura lanigera*) is undoubtedly the worst insect pest of the apple tree that we have to contend with. It belongs to a group of plant sap-suckers known as the Homoptera and to the family Aphidæ. All the aphids are small soft-bodied creatures of varying colours. The Woolly Aphis thrives particularly well in our South-West and Southern apple country.

The name "woolly" is applied to this insect owing to its habit of enveloping the body with a protective covering of white waxy filaments. This material is not woolly in the general sense of the term, but is a waxy secretion given off from the pores of the insect. It is water-proof, but easily melts when heat is applied, or can be readily blown off. This pest is especially to be found in damp cool situations and in badly kept orchards where trees are crowded or neglected. It is also difficult of control where the trees are not worked on blight-proof stocks or roots. The greatest damage is done to young trees up to 10 years. Older trees are less injured by the aphis attack. Certain varieties are also more subject to attack than others, while some varieties are aphis-proof.

CHARACTER OF INJURY.

On the trunks and upper portions of the tree the presence of the aphis results in the roughening of the bark, particularly about the collar, at the forks of branches, or around wounds caused by pruning. On the young growth, fruit spurs and buds, the pest is particularly damaging. If neglected, the fruit spurs and buds become aborted and merely blind swollen excrescences. Water shoots and other succulent growths are always badly infested. On the roots, if not blight proof, the same swollen and aborted state is to be found.

There is a great amount of misconception as to the nature of the injury produced by sap-sucking insects. Except during dry spells (which is our normal condition for 4½ months of the year), or when the numbers are excessive, or when they attack particular parts of the plant, the injury they do is scarcely worth considering. Under the conditions mentioned, however, they are often fatal to the plant attacked. No other class of injury renders a plant less able to pass through a drought successfully than that done by sucking insects. A dry moderately hot summer, such as we usually have in our apple country (excessive heat is fatal), is an ideal condition for the aphis and at the same time renders the tree less able to withstand the attack.

When infested by sucking insects a tree loses water at a rapid rate to supply the necessities of the aphides feeding upon the sap. The result under these conditions is the same as though the drought had been intensified; the leaves ripen and drop prematurely, the fruit is small, and in many instances sunburnt; and the young growth is distorted and useless.

The galls produced are caused by the continuous irritation set up by the piercing of the bark by the sharp beaks of the aphis. This has the effect of not only wounding the plant tissue, but promotes an excessive flow of sap to the injured spot, thus stimulating the spongy growth so typical of this pest.

The cost in labour, time and money, to say nothing of the loss of fruit, is annually very great. With a view to reducing these losses, the attention of the Entomological Branch has been directed to the procuring of the natural insect enemies. There are already existing many natural enemies such as ladybirds, syrphus and lace-winged flies, birds, etc. These, however, are not true or specific parasites, and therefore do not concentrate upon any particular species of aphis. Although useful, they do not by any means control Woolly Aphis, but still their combined effect upon destructive insects generally is absolutely essential, if man is to hold his own.

An instance of the value of their work is given. In preparing for the reception of the aphis parasite (*Aphelinus mali*) several slightly infested apple trees were enclosed in bird and insect-proof material, and the aphis allowed to increase unmolested by its natural enemies. The result was remarkable, for within one month of so covering the trees, they were literally swarming with aphis. In contrast to this the uncovered trees showed no increase of aphis, in fact, owing to the ladybirds, silver eyes, etc., the aphis decreased. This is a proof of how much we owe to the natural parasites already with us and without which man would be hopelessly beaten by the pest.

To increase this army of natural aids the internal chalcid wasp parasite (*Aphelinus mali*) has been successfully introduced and established. This parasite differs from any already operating in this State, in that it is an internal or true parasite. So far no useful internal parasite of Woolly Aphis has been noted in Western Australia. Efforts were made to introduce this tiny friend both from Africa and America. It is a native of America, and has been established in France, Africa, and New Zealand. Dr. Tillyard, of the Biological Department of the Cawthorn Institute, New Zealand, was responsible for the successful transportation of this valuable parasite: and to Mr. Grasby, of East Guildford, the Entomological Branch is indebted for permission to use his trees for the purpose of the experiment. This meant placing his block under temporary quarantine, owing to the possible danger of introducing Fire Blight from New Zealand per medium of the apple cuttings containing the parasitised aphis. The parasitised material was received on the 27th August, 1923, and immediately placed in breeding cages. The consignment consisted of some 30 apple cuttings heavily infested with parasitised Woolly Aphis.

It is well known that most chalcid parasites of injurious insects are themselves parasitised in turn by other species of chalcids, known as "secondary parasites" or "hyper-parasites"—"Big fleas have little fleas upon their backs to bite them, and so on *ad infinitum*." After placing the material in

the breeding cages a strict watch was kept for any insects other than the true parasite. Everything that emerged, other than the *Aphelinus mali*, was promptly despatched. It is obvious that if we can eliminate the secondary parasite we are going to get infinitely better results from our primary parasite. By allowing in and establishing the secondary parasite we largely nullify the work of the primary parasite.

It was unfortunate that the material forwarded was considerably delayed, taking some six weeks from the time of despatch from New Zealand until its arrival here. There was sufficient material forwarded to have bred out thousands of the parasites, but the bulk had issued during transit. Fortunately, however, we were able to breed out 168 females and 108 males. These did not all issue at once, but on various dates small colonies were collected and liberated in the prepared trees. The first lot were liberated on the 31st August, 1923, the last on 28th September, 1923.

Observations were continuously made, and on the 23rd October, 1923, we had the satisfaction of witnessing a definite issue of locally bred *Aphelinus mali*. From this date to the present time, the increase of the parasite has been remarkable. The trees to which the parasites were first applied were within three months almost free from living aphis, and the twigs and spurs were plastered with the dead swollen bodies of the parasitised aphis, showing the typical exit hole cut by the escaping adult parasite.

An encouraging feature in the establishment of this chalcid wasp was the finding of the parasite actively at work on the aphis some 100 yards from its original place of liberation. This is proof of the spread of the parasite by its own volition, and is an evidence of rapid adaptation to our local climatic conditions. If it maintains the high standard of parasitisation witnessed in the test trees, we have introduced a very active factor in the control of the Woolly Aphis. It has, of course, yet to be carried through the winter before a definite pronouncement can be made upon its value. Tests have been made with this parasite against the Black Orange Aphis, which is a serious autumn and spring pest to the citrus trees. To date the results are encouraging, as we have succeeded in breeding out the parasite from this aphis.

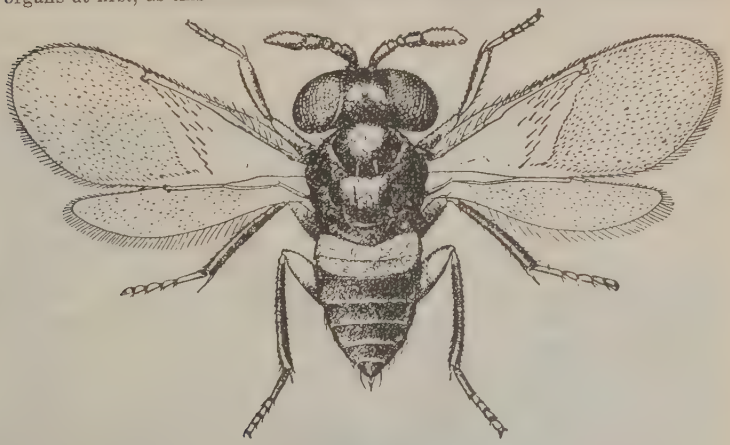
Colonies of the parasite have been forwarded to growers in all parts of the State. Some of the growers have gone to the trouble of covering certain experimental trees in their orchard, so keen are they to establish this labour and money-saving little insect. Encouraging reports have been received, and we have every prospect of the establishment of the parasite in all the apple districts of the State.

The adult parasite is a stout thickset chalcid wasp 1/25th of an inch long. The general colour is black, the terminal point of the antennae yellow, with a band of the same colour at the base of the thorax, wings transparent, and when at rest folded straight down the back, legs black, tarse or feet yellow.

The perfect or adult parasite has a very short life, the male living from three to five days, the female from five to seven. The females are very active during bright warm weather. On any such day they may be seen searching amongst the aphis and attacking same. The female selects her host and immediately inserts her tiny ovipositor into the body of the aphis. This act of laying causes much discomfort to the victim, which violently wriggles its body, or rapidly crawls away with the parasite attached. The tiny egg is passed down the ovipositor into the body of the aphis, one egg only being laid in each. This egg in turn gives rise to a tiny legless maggot, which feeds

PARASITISED WOOLLY APHIS.
Showing exit holes made by escaping parasite. (After Tillyard.)

within the body of the aphis until full grown, when it pupates within the swollen body of its host. The maggot whilst feeding does not attack the vital organs at first, as this would mean the death of its victim, and the consequent



ADULT MALE APHELINUS MALI, GREATLY ENLARGED.
(Actual size 1/25in. long.)
(From Bulletin 110, U.S.A. Bureau of Entomology.)

cutting off of its food supply. It attacks the fatty tissue of the aphis until almost full grown, when it consumes the whole contents of the body. Within this it turns to a pupa, finally issuing by cutting a hole through the tough chitinous skin of its host. This exit hole can be readily seen with the naked eye.

Once an aphis has become parasitised it never reproduces its species. Thus the death of every aphis due to the work of the parasite reduces the propagation of one of the most prolific injurious insects. The rapid rate at which the aphis increases has given rise to the impression that the insects come out of the plant upon which they are found. This, of course, is quite wrong. No insects are spontaneously generated, but are either hatched from eggs laid by the female parent or are born alive.

When the parasite has become established, the following conditions will be noted:—

1. The aphis will be observed to be highly agitated and moving from place to place.

2. The bodies of those well advanced in parasitism lose their woolly covering and become swollen and black.

3. After emergence of the wasp a distinct hole is to be noted in the body of the dead aphis.

As before stated colonies of this parasite have been liberated in various centres. It is the intention of the Entomological Branch to continue this work. Upon receipt of a consignment of parasites, the following conditions must be observed:—

1. Open package in orchard, and place cuttings in small tins or vessels containing moist sand.

2. Each tin containing one or more of the cuttings with the parasitised aphis should be placed in proximity to a badly infested branch. This will ensure the parasites finding suitable hosts ready to hand.

3. Each tree into which the parasites have been placed should be distinctly labelled.

4. Refrain from spraying marked tree.

5. When pruning in the winter, save as far as possible all cuttings carrying the parasite, and heel in at the base of trees affected with aphis.

6. When found established in any trees, the spread of the parasites can be greatly assisted by taking cuttings and placing same in other aphis-infested trees.

Just how many generations of *Aphelinus mali* will be produced annually under our climatic conditions has not yet been determined. It appears, however, judging by present indications, that a very useful purpose will be served the fruitgrowers by the successful introduction and establishment of this tiny insect friend.

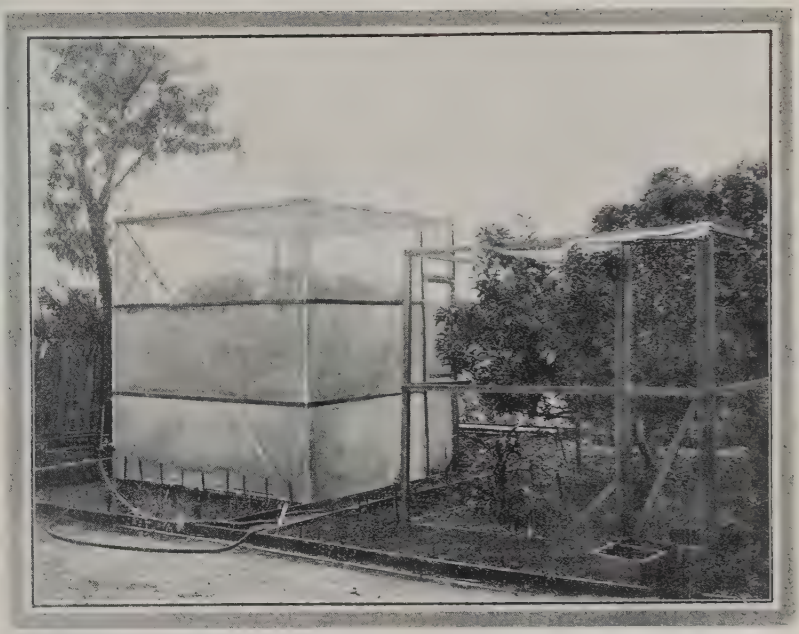
Note.—Since penning the foregoing the following interesting note has been received from Dr. R. J. Tillyard, who so kindly supplied the nucleus colony from which the parasite was successfully propagated and established:

"The success of *Aphelinus mali* in New Zealand this year has been little short of phenomenal. Reports come to hand almost daily of the fine work it is doing, and many orchardists have given up spraying for the aphis, relying wholly on the parasite. Also it has turned out a success in districts where, owing to bad weather conditions, it appeared to have failed last year, and we can now state that it is practically universally spread throughout the orchard areas of the Dominion. We have sent out over 80,000 living *Aphelinus* this Summer.

To ensure success in your State you should spread far and wide at the end of the Winter any parasitised twigs which you can spare, and also keep some covered trees going for a further big supply next Summer, and induce as many orchardists as possible to keep covered trees going for a year or two in their own orchards, until the little parasite is established throughout the orchard areas of your State.

You might bear in mind that *Aphelinus* has been observed here this year parasitising black aphis of lemon freely, also young Mealy Bug and the common Oyster Shell Scale, but it will not attack the well grown Mealy Bug."—L.T.N.

Advice to farmers on the way in which sales of growing crops are to be treated when making out income tax returns is contained in an order issued by the Federal Taxation Department. The general procedure is laid down as the result of legal advice from the Crown Law authorities. The amount realised by the sale of a growing crop is assessable income unless the crop is sold as part of a walk-in walk-out sale which puts an end to a taxpayer's business; while the purchaser of a growing crop, whether it form part of a walk-in walk-out sale or not, is entitled to deduct the price he paid for the crop, plus subsequent working expenses to harvest the crop, from the taxable amount of the sale of the crop after harvesting.



TEMPORARY BREEDING CAGES ERECTED OVER APHIS-INFESTED APPLE TREES.

1. Covered with bird-proof netting on the east and north sides. Top and wind side protected with strong scrim or hessian.

2. Tree after aphis had been destroyed by parasite. Netting and hessian removed to allow the natural growth, which quickly followed the destruction of the aphis.

PROTECTION OF USEFUL INSECTS, BIRDS, AND ANIMALS.

L. J. Newman, F.E.S.,
Government Economic Entomologist.

In view of the large settlement now taking place in our country districts it behoves settlers and farmers to exercise a judicious care in the destruction of native insects, birds, and animals.

The problem of insect control is largely influenced by the action of the checks provided by Nature on the increase of insects. This is termed "The Balance of Nature."

The most obvious check is that due to birds, bats, lizards, and other animals. There is also the less evident, though equally efficacious check from the hosts of predaceous and parasitic insects which attack their fellows. The predaceous insects are those which devour their prey from the outside, the most important among which is the great ladybird family (*Coccinellidae*). The true parasitic class are those which work in or on the body of their host. These latter are often microscopic in size, but are amongst the most effective of our insect friends. All insects tend to increase very much, and in natural conditions have to maintain their position against such influences as climate, weather, variable food supply, etc., and against their natural enemies. It is found under natural conditions that these factors tend to keep the numbers of any species within certain limits, though not always as narrow as we could wish.

When land is put under cultivation, the timber removed and foreign plants introduced, the balance of nature is disturbed, and the influence of beneficial birds and other insect enemies becomes altered. Man has then to fight not only the number of injurious insects that would be found under natural conditions, but also the increase due to the conditions he creates. He further has to cope with other introduced insects, which, owing to the absence of their natural insect enemies prove most difficult of control. Direct artificial checks then become necessary, but these may be reduced to a minimum by affording every encouragement to all natural checks. In fact, in many instances, if the natural checks are destroyed, we are powerless to control the pest.

It is, of course, impossible to avoid creating artificial and unnatural conditions in cultivated land, and man can only attempt to render these as favourable as possible to the maintenance of a natural balance of insect life. In order to effect this, every insect destroying creature should be encouraged unless it is proved that it has some bad habit which offsets its value as an insect destroyer.

It is frequently found that man himself, in shooting or trapping birds or by destroying their nests, is doing much to destroy bird life which is of much value to him, and such practices may be more effective in driving away bird life than the artificial conditions which attend cultivation. Where birds, lizards, toads, frogs, etc., are allowed to live unmolested they soon

accustom themselves to altered conditions, due probably to the abundant supply of insect food found in cultivated lands. We have in our own State many examples of where an insect has changed its native food for an introduced one. The Spring Beetle (*Colombymorpha lineata*) is a good illustration. This beetle in the adult stage attacks the blossoms and fruits of many orchard trees, causing considerable losses in some years. The wants of the Spring Beetle were at one time met by the supply of native bloom, but owing to the clearing of the country much of this has been cut out. Again, the clearing of the land has meant more grass lands, thus giving greater facilities for the breeding of this beetle, which in the larval or grub stage feeds on the roots of grass and shrubs. The bird life has also probably been reduced by the invasions of man and the attack of the escaped domestic cat. The beetle reported as responsible for the destruction of the mulga in the Murchison and other districts is another instance. The increase of this beetle is due to two main factors, namely, heavily stocking the country, which prevents the young plants from maturing and producing vigorous resistant trees, and the destruction of the native birds by cats. Then we have the effect of the introduction of insect and other pests per medium of trade. An insect like the Fruit Fly was introduced in imported oranges from the Mediterranean, and without any of its natural enemies is now a serious pest. The Potato Moth, all our orchard scales, aphides, and many other introduced pests, necessitate much labour and expense to control artificially owing to their having no natural enemies among the insects in this State.

Birds are an important and efficient check upon insect multiplication. It is doubtful if anywhere in the animal kingdom a restraining influence so important can be found. The effect of the bird upon an insect is to destroy it at once. When attacked by an insect parasite, the pest in many instances continues its destructive work until the larvae is full grown, the parasite only preventing a future generation, whereas the bird at once ends the destructive powers of the particular insect consumed. Another point in favour of birds as against insect parasites is their ability to travel long distances; they are able to rally quickly to any place and render good service in checking the further increase of the pest. It may be contended that birds are indiscriminate and will eat insects without regard to species or to their economic significance. It is quite true that in a bird's daily diet many useful insects are destroyed, but the true function of insectivorous birds is not so much to destroy this or that pest as it is to lessen the numbers of the insect tribe as a whole. That this is the true relation of birds and insects is proved from the fact that the two have lived together for countless ages, and the balance of nature has been preserved until disturbed by the operations of man. Birds have not wholly destroyed predaceous and parasitic insects on the one hand, nor have they exterminated any vegetable-eating pest, but they have successfully held the balance between the two. If we use artificial methods we still have the objection that both useful and destructive insects are destroyed. There is probably no way of destroying insects on a large scale that is not open to the objection that it kills friends as well as foes. Nature destroys indiscriminately, but produces in the long run the greatest good to the greatest number.

Many fruitgrowers condemn the Silver Eye (*Zosterops gouldi*) because it destroys during the months of January to March a small percentage of

soft fruits. The bulk of the food found in the stomach and crop of this bird is insect, particularly Scales and Aphides. The indiscriminate destruction of the Silver Eye or any other insect-eating bird may lead to a disturbance of the balance of nature.

The Crow (*Corvus coronoides*) has also been condemned by many people as a purely destructive bird and one that should be destroyed. The main charge against the crow is that it destroys young lambs, but it is a well-known fact that the lambs and ewes attacked are generally weaklings, and therefor it is to the ultimate advantage of the flock when they are eliminated.

We are experiencing an increasing plague of blowflies each year which cause considerably more damage to our flocks than the crows. Unfortunately the destruction of the crow is more systematically carried out by many farmers than the destruction of the blowflies. In many cases crows are shot indiscriminately, but the dead birds are left unburned, and provide a breeding ground for innumerable blowflies, which in the end prove a greater curse, and infinitely more destructive pest than ever the crow can possible become. The annual losses caused to flock owners by the crow fades into insignificance when compared with those caused by the blowfly. There is no sweeter morsel to a crow than a good fill of fly maggots. I have seen crows so full of maggots that they were scarcely able to rise on the wing. When we realise that a single blowfly can lay up to 1,000 eggs, it is obvious what benefit the crow is in destroying this disgusting and destructive pest. The crow is also responsible for the destruction of grasshoppers, cut-worms, etc.

One of the main factors in destroying the balance of nature in this State is the escaped house cat or domestic cat. This animal has increased in all districts, and was up till recently a protected creature. Unfortunately, the purpose for which the cat was protected—the destruction of young rabbits—has not been as effective as was anticipated. The cat has shown a greater preference for the feathered tribe and will, whenever opportunity offers, destroy them. The destructive nature of the cat makes it a doubly dangerous enemy, in that it will destroy life merely to gratify its passion for killing. It is safe to say that cats destroy in the aggregate more birds than all the native natural enemies combined. The offender is usually not the well-fed household pet, but those which have escaped into the bush, where they breed, become numerous, and destroy the native bird life. Cats will frequently devour frogs and toads and lizards, which are amongst our most useful insect destroyers. Sportsmen and bird lovers should therefore destroy the bush cat wherever possible.

In conclusion, it is suggested that every effort be made to interest and educate the public, particularly the young in the protection and recognition of our beneficial or friendly insects, birds and animals. By so doing so many of the dangers and errors of the past can be prevented, and much time, labour and loss prevented. The general tendency to-day to destroy ruthlessly and indiscriminately has frequently the opposite effect to what is intended.

LONGEVITY OF THE FOWL TICK.

(Argas persicus.)

L. J. NEWMAN, F.E.S.,
Government Economic Entomologist.

To test the longevity of this poultry pest when isolated from its host, an interesting and instructive test has been carried out. On the 20th November, 1919, a number of adult ticks were obtained and placed under observation. Observations were continued every week. The first action of interest was the laying of eggs by an isolated female on the 29th March, 1920, a period of four months after being isolated. These eggs proved to be fertile, and issued young on the 7th April, 1920, nine days after being laid. On 27th June, 1920, the young and parent tick were still active. On 4th July, 1920, the young ticks had all died, having lived three months without visiting a host. On 27th February, 1921, the parent tick died. She had laid fertile eggs four months after being isolated, and lived an isolated life of two years three months and two weeks.

Test 2 was with 10 ticks, eight females and two males.

On the 20th November, 1919, these ticks were placed under observation. The manner and times of observation were the same as with the single isolated female. Eggs were observed four months after isolation of adults. On the 7th April, young ticks issued from eggs, a period of nine days after laying. The death of the two males took place on the 5th and 7th April. They had lived without a food host for periods of four months 16 days and four months 18 days respectively. On the 4th July, 1920, the last young tick died without having visited a food host, making a life period of three months. On the 27th March, 1921, two female ticks died, the total isolated life being two years four months. On the 22nd November, 1921, two more ticks died, making a

total isolated life of three years. On the 1st November, 1922, three more ticks died, after a total of four years' isolation. On 24th April the last tick died, having lived the remarkable isolated life of four years five months.

It will be noted that the males were comparatively short lived. The single isolated female did not live as long as any individual one of the 10 placed together. The striking inference from this is that after a certain period the stronger sucked the body juices from the weaker, the last one to die being the "survival of the fittest," finally dying of old age. In the case of the single female, it is proved that the fowl tick is also capable of existing without food for a period of over two years.

From the data obtained by this test it is proved that the fowl tick is capable of a long life even when separated from its natural host. This fact makes its extermination extremely difficult. The removal of fowls from a yard with the idea of starving out the tick would necessitate their absence for several years, and it is therefore out of the question in most cases. The extermination must be undertaken by direct measures, such as the destruction by fire, or the application of caustic and burning washes to the infested premises.

SUMMARY.

Test 1—

(1) Isolated female lived two years three months.
(2) Fertile eggs produced four months after isolation.
(3) Young ticks lived three months without host.

Test 2—

(1) Males died four months after isolation.
(2) First female died at two years four months.
(3) Two females lived three years.
(4) Three females lived four years.
(5) Maximum time female lived, four years five months.

BREEDING A PERMANENT FLOCK.

Hugh McCallum,
Sheep and Wool Inspector.

The main object of the West Australian sheep farmer in breeding a permanent flock is to produce sheep of large frame, growing big fleeces of high-class commercial wool, and giving big returns per sheep. To accomplish this the beginner cannot do better than make a careful study of the methods adopted by some successful breeder in his own district, taking particular note of the style of managing each flock, and which type thrives best. If merinos are chosen, good cast-for-age breeding ewes from a good flock should be purchased. The advantage to be obtained here lies in the fact that these ewes have previously been included in the breeding flock. Purchasing young ewes generally means purchasing culls that were not considered good enough to use as breeders in a good flock. Otherwise they would not be for sale.

In building up a flock great care must be exercised. The important rule is to breed only from the best of both sexes, and retain for future breeding only those ewes which are apparently free from defect or faults. Cull all the others. A great mistake often made by small breeders is to use their own bred rams. Superior rams can usually be purchased from the owners of old established flocks.

Another mistake often made inadvertently is in the mating of sheep. To obtain the best results, similarity in all respects should be the first consideration. Many farmers through want of knowledge in this respect purchase rams and ewes of mixed types, and mate them indiscriminately, with the result that they do not breed to type. Sheep breeding is profitable only when high-grade sheep are bred and fed, and these require knowledge, patience, and constant personal care, so that nothing is left to chance. No ram of doubtful pedigree should be purchased, and where an hereditary defect exists the ewe to which that animal is mated should be particularly strong in the ram's defective characteristic. A similar practice should be followed regarding the ram where the ewes have a defective characteristic. The point to be remembered is that both sexes usually have one or more of the defects found in sheep, and the breeder must use the knowledge obtained from the pedigree to ensure that the same faults shall not be perpetuated on both sides, but as far as possible eliminated.

Improvement in sheep breeding is a gradual process extending over a considerable period, and it is only by following on the lines indicated that the small breeder can hope to be successful, and thus raise the standard of sheep breeding.

Good wool cannot be grown on sheep of indiscriminate breeds. Nor can wool defects be remedied by going to extremes, such as, for instance, using rams with long-stapled wool where the flock is lacking in length of wool. This practice has been detrimental in many flocks. The sheep to be mated should always be of the same relative merit, judiciously selected, and of sound constitution. The objects to be obtained are increased poundage of wool and a higher commercial value.

SHEEP NOTES.

Hugh McCallum,
Sheep and Wool Inspector.

The Care of Breeding Ewes.

Breeding ewes are the means by which the sheep farmer improves his flock, and to obtain the best results they should receive his most careful attention. The ewes should be kept on good pasture and not allowed to become too fat. The ewes will then produce good lambs and be capable of providing them with the nourishment necessary to make them strong and healthy. Ewes that have fallen into low condition during the summer months through lack of good pasture are unable to properly nourish their offspring,

with the result that losses occur amongst both. The percentage of lambs is also reduced, and this fact alone indicates defective management of the flock. Ewes with lambs at foot should receive green succulent food where possible to ensure a good milk supply for the lambs, while ewes in lamb should never be driven fast or harried by dogs. Crushing in yards or through gates should be avoided, and about a month before lambing the ewes should be crutched to avoid trouble with flies. When ewes are being crutched they should receive gentle treatment, and not, for instance, dumped in the shearing shed or pulled from the pens by the legs.

LAMBING.

The percentage of lambs raised largely depends upon the care given by the sheep farmer to his flock during lambing period. The points to be remembered by him are—constant daily attention to the ewes: looking after new-born lambs insufficiently strong to help themselves, by giving them their first drink, etc., and providing shelter and shade in the lambing paddocks. Undulating country is the best for the latter, so that the ewes and lambs may escape exposure to the cold winter winds. The increased percentage of lambs and value of the sheep will repay the trouble.

LAMB MARKING.

Lambs should be castrated when about two months old. All tools and knives should be well disinfected before and after use, and the best time is in the cool dry weather. The lambs should be yarded on the previous night, when possible, and the operations carried out before the heat of the day sets in. In the operations of ear-marking, castrating, and tailing lambs the animal to be operated upon should be held with its back against the attendant's leg, the latter gripping the fore and hind legs together on each side. In dealing with ram lambs the testicles are first removed by gripping the extremity of the purse between the thumb and forefinger of the left hand and with a sharp cut remove about a third, then grip the head of the purse and force the testicles outwards, seize them with the teeth and pull them steadily forward until they come out. If possible both testicles should be removed at once. Then pull the purse slightly forward to cover the broken skin, and thus keep out dust and dirt. When tailing, the skin should be forced up towards the head of the tail so that when the cut is made the skin will overlap the bone. The tail should be severed at the second joint, close to the body, with one sharp clean cut. All the cuts should be swabbed with a fairly strong solution of disinfectant, mixed with castor oil to keep the flies away until the wounds heal. When releasing the lamb it should be done so that the animal will drop on to its feet.

WEANING THE LAMBS.

The time of weaning depends largely on conditions, but as long as possible after marking should be allowed. The lambs should then be turned into a paddock containing a variety of soft feed and plenty of shade and water, also a few dry ewes for company. If left alone they are apt to become frightened, hang about the fences, and refuse to feed. It is most essential that they keep development as they only with difficulty recover from a setback at this period. That grass seeds are most prejudicial to lambs should also be remembered.

GOVERNMENT INSPECTION OF WHEAT.

G. K. Baron-Hay, B.Sc. Ag.
Agricultural Adviser.

Western Australia has established a reputation for the high quality of its wheat. For the last five years its f.a.q. standard has been the highest in Australia. In order that overseas buyers may have a reliable and definite assurance that the quality of the wheat purchased by them "unseen" shall conform to the f.a.q. standard of quality fixed by the Chamber of Commerce, and further that the quantity paid for shall be shipped, the Department of Agriculture has undertaken for those who purchase for shipment according to "The Government Certificate" as to weight and quality that the wheat shall be inspected prior to shipment and rejected unless it reaches the standard specified, also that the quantity shipped shall be accurately weighed and is as stated on the certificate.

This Departmental activity was first undertaken in 1913, when shipments to the Natal Mill Elevator Company were inspected. The company were so satisfied with the manner in which the work was carried out that they wrote the Department commending them for the work done. Owing to the introduction of the pooling system consequent upon the outbreak of the Great War the Departmental activity in this direction was in abeyance until last season, when 1,331,137 bushels of certificated wheat were exported. This quantity represented 24 per cent. of [illegible] ed. This year there has been a considerable increase in [illegible] wheat certificates, which to the end of February were given [illegible] bushels. This constitutes a record, and amounted to 61.3 per cent. of the wheat exported during the same period. The details of the shipments made to date are as hereunder:—

BOATS CARRYING CERTIFICATED CARGOES.

Ship.	Certificate.	Port of Discharge.	Bags.	Bushels.	Commenced Loading.	Completed Leading.
				bush. lbs.		
City of Milan ...	283–286	South Africa ...	14,845	75,373·21	...	28–11–23
Barrabool	287–288	Cape Town ...	8,640	26,252·20	28–11–23	30–11–23
Beltana	289	London ...	48,149	149,021·36	10–12–23	14–12–23
		Durban ...	12,007	37,226·00	...	...
Dongarra	291–292	Alexandria ...	4,172	13,044·48	11–12–23	17–12–23
Sutton Hall	293	Durban ...	7,136	22,381·48	17–12–23	22–12–23
Balranald	294	Cape Town ...	12,097	33,257·44	29–12–23	1–1–24
Hartington	295–298	Japan	75,373	231,875·56	27–12–23	31–12–23
Inkum	114–124	Japan	83,031	255,086·22	27–12–23	8–1–24
Abbekerk	125	Alexandria ...	24,272	73,739·35	4–1–24	9–1–24
Volga	01–10	Kobe	75,044	228,459·28	2–1–24	10–1–24
Sutton Hall	11–15	South Africa ...	21,570	65,069·12	5–1–24	11–1–24
Eibergen	16–20	Japan	91,556	279,648·8	17–12–23	11–1–24
Ryuoh Maru	21–41	Japan	87,042	265,799·48	27–12–23	14–1–24
Riol	42–43	Japan	94,126	284,708·40	15–12–23	15–1–24
Kratos...	44	Yokohama ...	59,670	179,270·56	11–1–24	19–1–24
Roman Prince ...	45–46	Japan	94,265	284,519·12	4–1–24	24–1–24
Aistern	47	Japan	56,240	168,706·32	21–1–24	30–1–24
Saikoh Maru	48	Japan	62,216	186,467·24	24–1–24	31–1–24
Suevic	51	London ...	12,150	36,900·00	31–1–24	1–2–24
Kenkyu Maru ...	52–56	Japan	84,447	254,943·16	21–1–24	5–2–24
Taiyu Maru	57–56	Japan	89,105	266,530·56	29–1–24	11–2–24
Sally Maersk	77–78	Shanghai ...	60,281	181,449·20	11–2–24	16–2–24
Manchu Maru ...	80–89	Japan	91,177	276,403·28	18–2–24	23–2–24
Totals	104	...	1,267,611	3,876,135·30	...	...

The increased activity in connection with the export of certificated cargoes has been largely due to the operations of Japanese buyers, as may be seen from the following summary which shows the destination of the ships carrying certificated cargoes.

TAKING SAMPLE FROM TRUCK.

INSPECTING SAMPLE FROM TRUCK.

Destination of Certificated Wheat Cargoes.

Japan	3,162,419	bushels
South Africa	346,345	„
China	181,449	„
United Kingdom	185,922	„
Total	3,876,135	„

The commercial value of any certificate indicating quality and weight depends upon its reliability. Believing that the ready acceptance of such certificates will facilitate trade and be of benefit to seller and buyer alike, because of the removal of the elements of risk and doubt on the part of the buyer, and of the prospect of even slight but probably acrimonious disputes from the mind of the seller, no effort has been spared by the Department to ensure that the inspection is so thorough and reliable as to make the certificates quite equal to their face value, and thus maintain the reputation which was gained with the first shipment. In this way the Western Australian certificates will rank with the best of those obtained elsewhere in the wheat exporting world.

If, as inferred, the sale of wheat on the basis of a Government certificate of weight and quality proves attractive to the buyer, then the practice of issuing them is of considerable value to the Western Australian wheat farmer, for it creates a greater demand and a better market for his product.

The first essential to insure that only wheat of the quality required to fulfil the conditions of the certificate is rigid and careful sampling. This is carried out at all ports by qualified samplers who are instructed to reject all wheat that is not clearly up to the standard required. Most of the wheat is loaded in trucks, and the first inspection of this wheat is in the trucks as they arrive and prior to being marshalled for despatch to the ship's side. This initial sampling is done at this stage so that in the event of trucks being rejected they may be shunted out of the way instead of being sent to the ship's side, where they would cause unnecessary interference with the work of loading. This work of sampling is illustrated in Fig. 1, which shows the inspector carrying out this phase of his work at Fremantle. On obtaining the sample it is examined and its acceptance or rejection quickly decided by the expert officer, as shown in Fig. 2. Should a sample prove unsatisfactory the bag from which it came is rejected, and if a number of bags of unsatisfactory quality are found in the same truck the whole truck is usually rejected, as this practice, because of difficulties connected with re-weighing and transport, generally suits the merchant better than the removal of a number of individual bags. Samples from both the rejected and accepted bags are collected, and for the purpose the inspector carries a bucket, as shown in the illustration (Fig. 2). This receptacle has been found most suitable for the purpose.

The "rejected" samples are retained for future reference in the case of disputes. The "accepted" samples are mixed with other accepted samples taken elsewhere prior to loading, for the purpose of ascertaining the bushel weight of the wheat being loaded.

To prevent undue delay with the loading operations, which must be carried out expeditiously, samples are taken at this stage from the bags readily accessible in the truck, mainly from those on the sides and along

the top. It is obviously impossible to quickly and easily obtain them from the bottom. To ensure that these are up to quality additional samples are taken as the bags are being conveyed into the ship. Should the wheat to be loaded have been previously stacked, each bag is sampled and rejected or accepted as it leaves the stack.

Up to this stage the inspection has dealt with the soundness and "cleanness" of the grain, no consideration being given to the quality as indicated by its "bushel weight." For this purpose the samples of the accepted bags obtained during the day from all sources—ex truck, elevator, or stack—are thoroughly mixed together, and its bushel weight ascertained by means of instrument known as the Chrondrometer, as illustrated in Fig. 4. The instrument used for this purpose is the only one of its kind in the State, and is the pattern legally recognised in New South Wales when legislation to deal with this aspect of the grain trade has been enacted. It is very accurate, and has been designed to eliminate differences due to the individuality of the operator, and thus avoid variable results.

In addition to determining the bushel weight of the amount loaded daily, that of the whole shipment is determined. For this purpose a composite sample of the daily loadings, each daily sample providing *pro rata* its share of the final sample, and sufficient so that this latter will weigh at least 80 pounds. This amount is obtained so that if desired the weight of the grain in the bushel measure can be determined in the same manner as is done when the f.a.q. standard is fixed.

To ascertain the weight loaded, the wheat is weighed, if being discharged directly from trucks, in truck lots over tested weighbridges, or if from stack in bag lots over scales. These weights, after being carefully recorded, are checked before being accepted for insertion on the certificate.

In addition to the commercial value of this work, the results should prove of educational value to the farmer. It is found that the quantity of wheat rejected amounts in the aggregate to a large quantity—in the case of the cargoes inspected to about 30,000 bags or 2.3 per cent. of the total quantity. Accepting this percentage as representing the condition of the harvest as a whole, and assuming the total yield to be 20,000,000 bushels, then the rejection would be 460,000 bushels. The principal cause of rejection is smut, assuming that the average reduction in price on account of infection to be only 3d. per bushel, this represents a loss to the farmers of nearly £7,000.

The very unsatisfactory feature about this loss from smut is that it can be entirely preventible if the farmers concerned only take thorough precautions against the introduction of this disease into their crops by the use of any of the fungicides recommended for this purpose, viz., Copper Carbonate, Copper Sulphate and Lime, and Formalin.

The system of wheat inspection at the wharf therefore serves a dual purpose—it provides the overseas buyer with a guarantee that his purchases are of standard quality, and it indicates to the grower in no uncertain manner the necessity for growing clean wheat if he wishes to obtain the full market value for his commodity. This is much more important from the fact that the growers in Argentina, Canada, and the United States are so much nearer the world's markets than are those of Western Australia, and the handicap can only be reduced by the latter's attention to the details of quality and cleanness in order to keep his standard equal to, if not superior, to those of his overseas competitors.

TAKING SAMPLE AT GANTRY BEFORE LOADING INTO SHIP.

USING THE CHRONDROMETER.

In order to render comparison possible between varieties growing at ne distance from each other, the actual yields have been calculated as per-ntages of the "natural" yield of the control variety. This natural yield the yield which it is estimated the control would have yielded had it been anted instead of the variety being compared.

This conventional estimation is based upon the assumption that the ference between neighbouring "control" plots is due to regular and gradual riations in the soil between them. All the check plots are treated in exactly e same way. It is therefore reasonable to believe that any difference be-een neighbouring plots is due to variations in the soil. Because such con-ol plots are not widely separated it may also be assumed that any variation regular and gradual. The "natural" yield of any plot will therefore be termediate between that of the two control plots on either side of it and oportionate to the distance from.

The varieties arranged, according to their percentage yield, are as fol-w :—

PERCENTAGE YIELDS.

Hay.				Grain.			
Chapman.		Merredin.		Chapman.		Merredin.	
Variety.	% Yield.	Variety.	% Yield.	Variety.	% Yield.	Variety.	% Yield.
esley	103	Canberra ...	106	Gresley ...	118	Nabawa ...	106
nyas Early ...	100	Gresley ...	103	Merredin ...	110	Gluyas Late ...	104
ndilla King ...	96	Gluyas Early ...	100	Yandilla King...	105	Canberra ...	103
rredin ...	88	Gluyas Late ...	97	Nabawa ...	103	Merredin ...	103
bawa	87	Florence ...	96	Toby's Tusk ...	102	Gluyas Early	100
meback ...	86	Carrabin ...	94	Dindiloa ...	100	Federation ...	95
by's Tusk ...	84	Belka	92	Gluyas Early ...	100	Carrabin ...	91
H. J. ...	83	Hard Federation	91	Comeback ...	90	Gresley ...	90
ndiloa	82			Carrabin ...	89	Nangeenan ...	88
rrabin ...	81	Merredin ...	90	S. H. J. ...	86	Hard Federation	86
brence	78	Federation ...	89	Florence ...	76		
		Nangeenan ...	89			Belka	82
		Nungarin ...	87			Nungarin ...	82
		Nabawa ...	84			Florence ...	72

FARM WHEAT CROPS COMPETITION.

H. Rudall,

Field Officer, Agricultural Department.

The aim of every good farmer is to obtain maximum yields. One of e best aids in this direction is the healthy rivalry engendered by com-tition, supported by a study of the methods of the competitors with the ject of learning how those by which the best crops were obtained can be plied to other farms and improved yields obtained.

With the object of increasing the State average yields by stimulating dividual farmers generally to increase their own average yields over the

whole farm, the Department of Agriculture, in co-operation with the Royal Agricultural Society, generously assisted by the two Fertiliser companies manufacturing superphosphate in this State, who donated the prizes, initiated a wheat crops' competition which applies to the whole of the farm wheat crops harvested for grain.

The competition has been designed to ensure, as far as possible, that it will be won as the result of merit only and not because of accidental results consequent upon a specially good season. For this reason a prize —a valuable cup—is awarded to the competitor who obtains the greatest aggregate number of points over a period of three years. Yearly prizes, in addition to the final ones, are also given to competitors who obtain the most points in each of the three years over which the competition extends. Each competitor has thus an opportunity of winning four prizes during the course of the competition.

To ensure that crops are grown strictly on commercial lines, an essential condition is that the minimum area cropped shall not be too small. It is, however, necessary that this minimum area shall not be so great as to exclude the farmer who relies principally on his own efforts and does not employ labour. For these reasons the minimum area harvested for grain on the farm has been fixed at 150 acres.

The method of judging has been designed to eliminate the element of estimation, and is as follows:—The judge visits the farm of each competitor, closely inspects the whole of the stripping area, and allots points for freedom from weeds, disease, and admixture of other varieties, and evenness of growth. When the harvesting has been completed, and the crop disposed of, the competitor forwards to the judge the number of bushels obtained from the area, and the number disposed of and retained for seed. Before making the award the quantity of grain harvested is verified by means of the merchants' tally notes, and the area stripped is checked by measurement. Having the total yield and the measured stripping area, the judge calculates the average yield per acre of the farm. Points are awarded accordingly, added to those already given, and the farmer gaining the highest aggregate number is adjudged the winner.

It will be recognised that the prize is gained, not merely for the greatest number of bags obtained from specified and presumably specially prepared areas, but for results obtained over the whole of the farm, and if on one farm, why not on many farms? In fact, why not generally throughout the zone in which the winner is located? Intelligent thought and study given this question by the majority of the wheat farmers should quickly raise the average wheat yield of the State.

For the purpose of this competition, the wheat belt is divided into three zones which roughly approximate with the rainfall areas as follows:—Early Zone with rainfall under 15 inches. Midseason Zone over 15 inches and under 20 inches, and Late Zone over 20 inches.

In each zone cash prizes of £5 and £3, respectively, are to be awarded to the two competitors gaining the highest number of points each year. At the end of the three years the competitor who has gained the highest aggregate marks in each zone during this period will be awarded a "Champion Cup" valued at £20.

Because it includes all the wheat crops stripped on the wheat farm, and lso on account of the essentially practical and commercial conditions sur-ounding this competition, it will be great merit to win it, and the winner ill bring considerable honour into his district by so doing. It is therefore ie interest of every good farmer to enter, and the duty of progressive local odies to see that their districts are properly represented.

Entries for this competition close on June 30th 1924. Details regarding were finalised during last Winter, but it was deemed desirable that the ompetition should not commence until the present season. A preliminary ompetition for one year on the same lines was arranged in order that the nevitable initial difficulties might be overcome.

The report of the Field Officer, Mr. H. Rudall, concerning the judging f this competition is appended hereto:—

Herewith I submit the report of the Farm Wheat Crops' Competition. his being the first year in this class of competition, the entries received, umbering 41, are regarded as satisfactory. At the time judging was being arried out 24 entries were withdrawn, and of those judged in the field even failed to send in the details of the wheat sold and retained, in accord-nce with an intimation sent to all competitors. This was regarded as a acit admission that they had decided after harvest to withdraw from the ompetition.

In No. 1 Zone the judging was carried out jointly by Mr. I. Thomas, Manager Chapman Experiment Farm, and myself, and No. 2 Zone by Mr. rmstrong, Agricultural Adviser, and myself. There were no entries from armers in No. 3 Zone.

Details of the awards, and particulars of the judging, are given here-nder:—

FARM WHEAT CROPS.

No. 1 Zone.

Average annual rainfall 10 to 15 inches.

Judges:—Mr. I. Thomas, Manager Chapman Experiment Farm; Mr. H. Rudall, Field Officer.

Name of Competitor.	District.	Acres.	Actual yield.	Average	Yield.	Freedom from weeds.	Freedom from disease.	Freedom from admixture	Evenness of growth.	Total.
			bus.	bus.	*35	*25	*15	*15	*10	100
ammond, J. D....	Kellerberrin ...	521	10,500	20	32	20	13	13	8	86
radford, R. & L.	Ballidu ...	421	9,449	22	35	17	11	11	7	81
cCarthy, P. & Sons	Eujinyn ...	793	15,581	19½	31	17	12	12	7	79
thlean, J. ...	Bruce Rock ...	467	8,979	19	30	18	10	13	7	78
ohnson, W. D. ...	Bruce Rock ...	551	9,462	17	27	16	12	11	7	73
edges, W. N. ...	Koolberrin ...	1,135	18,667	16	25	17	11	11	7	71
arling, H. & H.	Belka ...	545	9,090	16	25	16	12	11	7	71

* Points.

Mr. J. Deane Hammond, of "Cuttening," Kellerberrin, is awarded the rst place with 86 points out of a possible total of 100. This competitor

and his district have every reason to be proud of his successes this year. Winning, as he has, the District Competition for the best 50 acres of wheat of one variety, then securing the Royal Agricultural Society's prize against strong competition from all the competitors in the various District competitions in the South-Eastern Zone, and finally securing the blue ribbon for the best average actual (not estimated) yield for all the wheat crops harvested for grain. This latter prize should be greatly coveted, not only by the competing farmer, but also by the district in which he lives, for to win it is a real test of good and consistent farming.

The stripping area totalled 521 acres, and a glance at the details of the award will show that the whole of this area must have received very sound treatment to obtain so near the possible number of points allotted in each section.

The main varieties planted consisted of Nabawa, Gluyas Early, Florence, Merredin, and Gresley. Smaller areas for trial purposes consisted of Canberra, Comeback, Carrabin, Caliph, and Clarendon. In addition to this, there were also rate of seeding, and rate of superphosphate trials carried out under the supervision of the Agricultural Department; these occupied 10 acres.

The land under crop is of mixed quality, from heavy clay to light jam country.

The marked feature of the whole area was the absence of disease in all crops, and the freedom from admixture amongst the varieties.

Four hundred and thirty-one acres were fallowed; the ploughing was done with Shearer and Massey-Harris mouldboard ploughs in 1922 during the months of June, July, and August to a depth of four inches. The land was cultivated (Springtyne) in September and October, worked with a tandem disc in November, and in March, 1923, and same in May after rain. The lumpy ground was worked with a pulveriser roller. Two disc drills were used—a 20 and 16, respectively. The latter was a "Suntyne" combined drill and cultivator; the land on which this was used was harrowed after seeding between the end of March and end of May. The quantity of seed sown varied from 60 to 70 lbs., and the application of super. from 120 to 168 lbs. per acre, the heavier dressings being on the light land.

Ninety acres planted with "Florence" were unfallowed. The land was ploughed four inches deep in May and immediately sown. All seed was pickled with bluestone and no smut was discernable. All those varieties liable to shed were harvested first.

The monthly rainfall recorded during the year was as follows:—January 44, February 42, March 31, April 182, May 153, June 490, July 104, August 69, September 168, October 15, November-December 162. Total 1,460 points. Total for growing period 999 points.

The second award in this zone was made to Messrs. R. and L. Bradford, of "Towella," six miles from Damboring Siding and nine miles from Ballidu township. They are to be congratulated as being the competitors to obtain the highest average yield of 22 bushels from 421 acres. This property was originally taken up by Messrs. Bradford Bros.' father 10 years ago as virgin

country. Mr. Bradford, sen., enlisted and saw service. These two sons, still in their teens, carried on working and further improving the farm. On his return from the war, Mr. Bradford's (sen.) interest was bought by the two sons who are now in partnership. The holding now comprises 2,124 acres, 1,000 acres being cleared consisting of 700 acres of Gimlet, Salmon and Morrell country, and 300 acres scrub plain. These young men have purchased a tractor for their work, but have retained a team of horses to supplement its operations.

Sheep were obtained for the first time during the past season, and now that they are available, Messrs. Bradford Bros. are endeavouring to crop their farm on the three-course system of fallow, crop, and stubble grazing. Four hundred and seventy acres were under crop last season, 421 being stripped for wheat, the balance being oats and wheat cut for hay. The varieties were Major, Gresley, Nabawa, Gluyas Early. Two hundred acres were fallowed. The fallowed land was ploughed during July and August, 1922, with a McKay 4-furrow disc plough; cultivated with a Smith cultivating plough in September; repeated before seeding. All seed used was graded and pickled with bluestone solution. Commenced seeding with 50 lbs. per acre in April, finishing 25th May with 55 lbs. The fallowed land received 80 lbs. and unfallowed 90 lbs. of superphosphate to the acre.

The monthly rainfall was as follows:—January 22, February 9, March 73, April 181, May 116, June 626, July 167, August 100, September 170, October 20, November-December 110. Total for 1923, 15.94 points. Total for growing period 1,199 points.

Messrs. P. M. McCarthy & Sons, of Eujinyn, seven miles from Bruce Rock, who obtained third place, had a stripping area of 793 acres, consisting of 743 acres of fallowed and 50 acres of unfallowed land. Nearly 400 acres were planted with "Nabawa," and just over 300 acres with "Canberra," the balance being "Gluyas Early" and "Hard Federation." The majority of the country is Salmon, Gimlet, and Morrell soil. The system of cropping is fallow and crop, with the ploughing done as early as possible; the cultivating as soon as ploughing operations are completed; again during Spring; and during Summer when required to destroy weeds and prevent the ground from setting hard. The ploughing was done in June, July and August, 1922, with a mouldboard and heavy disc plough, cultivating in August and September, 1922, and March, 1923. The seed was sown with a combined drill in April, May, and first week in June with 60 lbs. seed and 80/90 lbs. of superphosphate to the acre. All seed was graded and there was almost a total absence of barley. No smut was noticed.

As a whole the land was most consistently prepared and well above the average for such a large area, but weed growth was noticeable.

No sheep are kept on this holding, and this competitor would be well repaid for the expenditure incurred in making the necessary provision for them. He would be surprised at the assistance they would give him, if only to keep the fallow clean.

The monthly rainfall recorded during the year was as follows:—January 48, February 110, March 62, April 187, May 116, June 338, July 76, August 86, September 193, October 33, November 96, December 178. Total 1,523 points. Total for growing period 842 points.

Although no award was won by Mr. W. Hedges, commendatory attention must be drawn to the very satisfactory average yield of 16 bushels per acre from over 1,100 acres.

No. 2 ZONE.

Average Annual Rainfall 15 to 20 inches.
Judges :—Mr. J. T. Armstrong, Agricultural Adviser. Mr. H. Rudall, Field Officer.

Name of Competitor.	District.	Acres.	Actual yield. bus.	Average bus.	Yield.	Freedom from weeds.	Freedom from disease.	Freedom from admixture.	Evenness of growth.	Total.
					*35	*25	*15	*15	*10	*100
Hebiton, J. K. ...	Three Springs	426	10,885	25½	35	20	12	11	8	86
Scott & Chappell	Dumbleyung...	223	5,535	25	34	20	11	11	8	84
Mott, C.	Moulyinning...	228	5,012	22	30	18	11	10	8	77

* Points.

It is fitting that Mr. Jas. K. Hebiton, of Three Springs, whose name has previously been before the public in connection with cereal growing by winning the *Sunday Times* Cup for the champion bag of wheat four times at the Royal Agricultural Society's grain competitions, should obtain the first award in this zone.

The stripping area totalled 426 acres, averaging 25½ bushels to the acre. The main varieties planted were Nabawa, Gluyas Early, Major, Federation, Carrabin, and Gresley. Smaller acreages of Yandilla King, Comeback, and Firbank was also grown. An area of 113 acres was fallowed. Ploughing was commenced in May, 1922, cultivated (Springtyne) and rolled with T-bar roller in August, disc-cultivated with Sundercut in September and October. Cultivated again in front of the drill. Seeding with the late varieties started on April 23rd, 1923, with 56 lbs. of graded seed and from 60 to 90 lbs. of superphosphate to the acre.

Two hundred and thirty-three acres of new land was prepared with Sundercut disc cultivator and immediately drilled. All seed was graded and dry pickled, sown at the rate of 40 to 60 lbs. of seed and 56 lbs. of superphosphate to the acre; commenced on the 7th May.

Eighty acres of old land were planted, 30 acres of which was ploughed with a Sundercut about four inches deep and sown with 40 lbs. seed, Nabawa variety, graded and dry pickled, and 84 lbs. of superphosphate on May 14th. Fifty acres, which were very boggy, were ploughed with a mouldboard and sown with 60 lbs. Gluyas Early variety, graded and dry pickled, and 84 lbs. superphosphate, commenced on June 1st.

The yearly rainfall was as follows:—January 23, February 16, March 66, April 149, May 84, June 799, July 300, August 105, September 108, October 30, November nil, December nil. Total 1,686 points. Total for growing period 1,426 points.

Messrs. Scott and Chappell, situated five miles from Dumbleyung, gain second award in this zone with a stripping area of 223 acres, averaging 25 bushels. The land is flat and carried originally Salmon Gum and Mallee, the soil heavy grey clay and becomes very boggy in winter.

The bulk varieties were "Queen Fan," "Turvey," Wilfred," and "Gluyas Early." These competitors are great believers in harrowing, and harrow their land frequently. Several of the varieties were badly affected with Take-all.

The best paddock was one of Gluyas Early. This was a splendid crop, thick and very well headed.

The land was ploughed at the end of July and early August, harrowed several times in the Spring, cultivated (Springtyne) in May, harrowed twice, drilled with 65 lbs. seed and 140 lbs. superphosphate to the acre in the second week in June and harrowed twice afterwards.

A special plot of eight acres of Gluyas Early was prepared as previously stated, but harrowed more. It was sown on July 13th at the rate of 110 lbs. seed and 280 lbs. superphosphate to the acre. This was, to all appearances, a heavier crop, but it is doubtful if the expense of the additional seed and fertiliser will be justified by the yield.

The yearly rainfall was as follows:—January 47, February 34, March 60, April 156, May 324, June 415, July 139, August 113, September 324, October 40, November 2, December 11. Total 1,665 points. Total for growing period 1,355 points.

Mr. C. Mott, situated three miles from Moulyinning Siding, was the only other competitor in this zone. His acreage was 228 acres with an average of 22 bushels. The bulk varieties were "Lott's," "Nabawa," "Gluyas Early," and "Gresley."

Two hundred and twenty acres were under oats. Mr. Mott's rotation is fallow, wheat, oats, selfsown oats and pasture, then fallow.

EXPERIMENTS WITH WHEAT.

Geo. L. Sutton,
Director of Agriculture.

LATE SEEDING EXPERIMENT.

There is a very general belief amongst growers in the Wheat Belt that seed planted later than May will not produce as high a yield as that planted earlier. Realising, however, that from a grain producing standpoint late planting has many advantages and particularly on rich weedy and well prepared land, it was decided to carry out experiments on the Chapman and Merredin State Experiment Farms to determine the effect of seeding later than May.

The experiment was planted so that plots were seeded respectively about the middle of May, June and July. The arrangement of the plots is shown hereunder. Each plot was the width of the drill and 10 chains long, and was repeated three times.

Planted May.
Planted June.
Planted July.

The actual dates of planting were, at Chapman, May 15th, June 12th, and July 10th; at Merredin, May 14th, June 13th, and July 16th. At both farms

the experiment was planted on fallowed land, and the cultivation, fertilising and seeding for all plots was the same. At Chapman the ground was ploughed in August, 1922, cultivated in March, and again twice before seeding. At Merredin the ploughing was done in June, 1922, and the land was cultivated in September, February, and prior to the May seeding. At both farms the June plantings were cultivated prior to seeding, and those of July had cultivation in June and also before seeding in July.

The variety used was Gluyas Early and was sown at the rate of about 50 lbs. per acre. The fertiliser used was superphosphate, 22 per cent., at the rate of 112 lbs. per acre.

The rainfall for the year was as hereunder:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for Year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Chapman ...	22	16	45	91	144	1,250	207	181	138	68	1,988	...	10	2,172
Merredin ...	41	136	27	170	131	479	123	54	125	31	946	...	249	1,569

Owing to the heavy rainfall at the Chapman Farm, which caused the ground to become boggy, it was only with difficulty that the June and July seedings were made, and even then it was not possible to sow the seed the full length of the plot.

The plots were harvested when mature. The June and July plantings matured about the same time and were much shorter than the May plantings, which matured a fortnight earlier.

The results obtained are as follow:—

MERREDIN.			CHAPMAN.		
Planted, May 14th.	Planted, June 13th.	Planted, July 16th.	Planted, May 15th.	Planted, June 12th.	Planted, July 10th.
Yield computed.	Yield computed.	Yield computed.	Yield computed.	Yield computed.	Yield computed.
bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
32 48	24 56	16 32	20 30	18 31	12 50
36 8	27 52	15 12	21 29	18 16	15 48
33 44	29 52	15 36	24 34	16 12	15 10
Average 34 18	27 33	15 47	22 11	17 40	14 36
Percentage ... 100%	81%	46%	100%	79%	66%

The results, though from an experiment conducted during one year only, provide very strong and distinct evidence as to the necessity for not deferring the seeding after May, when the climatic conditions are similar to those of the districts represented by the Experiment Farms. It will be noticed that the reduction in the yield of the later plantings is not as great at Chapman as at Merredin. It is believed that is due to the better rainfall which fell at Chapman after the seeding. The rainfall at Chapman during the three Spring months—August, September, October—was not only 77 per cent. greater than at Merredin, but the advantage also continued to the end of the period.

These results, when considered in connection with the rainfall, confirm the general opinion that success with later sowings than May is dependent

upon better rains in October than are experienced in most of our wheat districts. At the Chapman Farm a heavy June rainfall of over 12 inches nearly prevented the June and July plantings being made. Though this rainfall was abnormal, the average for June (354 points), and July (407), is such as to make June and July sowings doubtful any year. This is an additional reason why in that and similar districts the seeding should be completed in May, however desirable it may be to delay seeding in order to control weed growth.

RATE OF SEEDING EXPERIMENT.

Since 1912, at the Chapman Experiment Farm, and since 1913, at the Merredin Farm, seeding trials have been conducted. With the exception of the first year at Chapman the trials have been carried out each year with two varieties—a free stooling or mid-season, and a sparse stooling or early variety. The land for this experiment was fallowed, cultivated, and fertilised in the same manner as the main crops of the farm. Except as regards the rate of seed per acre, all the plots are treated identically, the date of planting being about the middle of May and the rate of fertiliser 70 to 80 lbs. per acre. Until this year the plots, for comparison, were the width of four drills and about 10 chains long.

This year, in accordance with the general rearrangement of the method of conducting the experiments, each plot is the width of one drill and the same length, but is repeated eight time, three of the plots being cut for hay and five for grain. The detailed results of the experiment are given herewith:—

MERREDIN EXPERIMENT FARM.

HAY.

MID-SEASON VARIETY—NABAWA.	30lbs. seed per acre.	45lbs. seed per acre.	60lbs. seed per acre.
	ct. qr. lb.	ct. qr. lbs.	ct. qr. lb.
	46 1 20	53 2 21	54 3 1
	51 0 8	52 3 12	50 1 12
	46 1 20	48 3 7	51 1 7
Average per ac.	48 0 0	51 3 4	52 0 16
Per cent. ...	93%	100%	101%

EARLY VARIETY—FLORENCE.	30lbs. seed per acre.	45lbs. seed per acre.	60lbs. seed per acre.
	ct. qr. lb.	ct. qr. lb.	ct. qr. lb.
	45 0 27	48 0 11	49 1 17
	47 1 1	46 3 4	49 2 16
	48 2 21	50 1 25	44 0 5
Average per ac.	47 0 8	48 1 20	47 2 24
Per cent. ...	97%	100%	99%

GRAIN.

MID-SEASON VARIETY—NABAWA.	30lbs. seed per acre.	45lbs. seed per acre.	60lbs. seed per acre.
	bus. lbs.	bus. lbs.	bus. lbs.
	27 33	28 40	26 13
	26 40	29 33	26 40
	28 53	29 47	28 40
	30 0	27 33	30 40
	27 20	30 40	26 40
Average per ac.	28 5	29 15	27 47
Per cent. ...	96%	100%	95%

EARLY VARIETY—FLORENCE.	30lbs. seed per acre.	45lbs. seed per acre.	60lbs. seed per acre.
	bus. lbs.	bus. lbs.	bus. lbs.
	22 27	20 27	19 7
	17 33	19 7	22 0
	20 53	19 7	18 53
	18 27	18 13	20 40
	17 20	22 27	20 40
Average per ac.	19 20	19 52	20 16
Per cent. ...	97%	100%	102%

When this season's returns are combined with those of previous years, the averages for the period since this experiment was commenced in 1913 are:—

	HAY.				GRAIN.			
	Mid-season Variety.	%	Early Variety.	%	Midseason Variety.	%	Early Variety.	%
	ct. qr. lb.		ct. qr. lb.		bus. lb.		bus. lbs.	
30lbs.	43 2 24	94	44 3 4	96	19 55	95	20 43	98
45lbs.	46 2 8	100	46 2 24	100	21 4	100	21 12	100
60lbs.	46 3 12	101	44 1 20	95	20 40	98	21 7	100

CHAPMAN EXPPERIMENT FARM.

At the Chapman Experiment Farm the average results for the term of the experiment, 1912-1923, are:—

	HAY.				GRAIN.			
	Late Variety.	%	Early Variety.	%	Late Variety.	%	Early Variety.	%
	ct. qr. lbs.		ct. qr. lbs.		bus. lbs.		bus. lbs.	
30lbs.	15 3 20	90	13 1 4	87	12 24	90	9 12	83
45lbs.	17 2 24	100	15 1 12	100	13 44	100	11 4	100
60lbs.	18 3 12	106	15 3 12	103	13 17	97	11 17	102

The results are very similar, but with a slight indication in favour of a heavier seeding than 45 lbs. for hay purposes. It was therefore decided to alter the rates of seeding to 45, 60 and 90 lbs. per acre, and at the same time increase the rate of fertiliser to 150 lbs. of 22 per cent. superphosphate per acre, for the opinion had been advanced that the full benefit could not be derived from the increased rates unless the quantity of fertiliser was also increased. The yields obtained this year are as hereunder:—

HAY.

LATE VARIETY—YANDILLA KING. Planted May 10th and 11th—Harvested Oct. 19th.				EARLY VARIETY—FLORENCE. Planted May 12th—Harvested September 20th.			
	45lbs. seed per acre.	60lbs. seed per acre.	90lbs. seed per acre.		45lbs. seed per acre.	60lbs. seed per acre.	90lbs. seed per acre.
	ct. qr. lb.	ct. qr. lb.	ct. qr. lb.		ct. qr. lb.	ct. qr. lb.	ct. qr. lb.
	28 0 4	30 1 12	28 3 20		13 2 8	14 3 12	17 0 0
	28 0 0	28 1 20	28 2 20		13 3 4	14 2 16	16 3 20
	27 2 16	30 2 0	28 3 4		14 0 8	16 0 24	22 1 12
Average per ac.	27 3 23	29 3 4	28 3 1	Average per ac.	13 3 7	15 0 27	18 3 1
Per cent. ...	100%	107%	103%	Per cent. ...	100%	110%	136%

GRAIN.

LATE VARIETY—YANDILLA KING. Planted May 10th and 11th—Harvested Dec. 10th.				EARLY VARIETY—FLORENCE. Planted May 12th—Harvested November 3rd.			
	45lbs. seed per acre.	60lbs. seed per acre.	90lbs. seed per acre.		45lbs. seed per acre.	60lbs. seed per acre.	90lbs. seed per acre.
	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	bus. lbs.	bus. lbs.
	26 40	27 33	26 53		18 26	19 33	19 6
	28 0	29 33	28 53		20 0	21 6	21 6
	29 20	28 26	27 46		18 53	19 46	18 40
	28 40	29 6	27 33		16 53	16 53	17 46
	28 53	29 20	26 40		14 40	15 46	15 33
Average per ac.	28 19	28 48	27 33	Average per ac.	17 46	18 37	19 26
Per cent. ...	100%	102%	97%	Per cent. ...	100%	105%	104%

The winter rainfall during the course of this experiment was heavy. The results indicate that with such a rainfall a heavier seeding than 45 lbs. for either hay or grain is desirable. As, however, the rainfall during the past season was abnormal, and the experiment is only of one year's duration, they cannot be accepted as conclusive for this or districts of similar climatic conditions.

Farmers' Results.

Under the supervision of the Field Officer, Mr. H. Rudall, rates of seeding trials were carried out by Messrs. W. J. Eva, Gutha; J. D. Hammond, "Cuttening," Kellerberrin; and Teasdale Bros., "Cumberland Farm," Belka. These trials were all on fallowed land. Each plot was in duplicate. The average acre yields of the two plots and other details are as hereunder:—

	Belka.		Gutha.		Kellerberrin.	
Variety Superphosphate Planted.	Merredin, 150lbs. per acre, May.		Federation, 75lbs. per acre. May.		Gluyas Early, 125lbs. per acre. May.	
Seed per acre. lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.
50	30	23	19	32	44	28
75	30	32	20	27	23	20
100	30	24	19	28	24	19

These results support those obtained at the Experiment Farms, which show that in early districts there is no advantage in using more than 45 to 50 lbs. of clean seed per acre.

RATE OF SUPERPHOSPHATE EXPERIMENT.

With the object of determining the most economical application of superphosphate to make at time of planting, experiments have been initiated during the past season at the Chapman and Merredin Farms.

The land at Merredin on which the experiments were carried out is a heavy clay loam typical of the land carrying Salmon Gum and Gimlet Timber. The land at Chapman is much lighter sandy loam, formerly covered with Jam scrub. At both farms the land was ploughed during the Winter of 1922, brought to a good tilth by subsequent cultivation, and was also cultivated immediately prior to seeding. The superphosphate, at the rates shown in the table, was drilled in with the seed, which was at the rate of 60 lbs. per acre.

The computed acre yields obtained were as follow:—

CHAPMAN EXPERIMENT FARM.

Hay.			Grain.		
75lbs.	150lbs.	225lbs.	75lbs.	150lbs.	225lbs.
ct. qr. lbs.	ct. qr. lbs.	ct. qt. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
17 2 0	21 0 18	24 3 4	18 16	20 40	20 56
20 0 24	25 2 24	28 1 12	19 20	21 44	22 16
22 0 0	27 1 12	32 2 13	17 44	20 56	21 4
...	...	...	18 24	20 40	21 20
...	...	...	19 4	21 20	21 20
Average Yield per Acre.					
cwts. qr. lbs.	cwts. qr. lbs.	cwts. qr. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
19 3 17	24 2 27	28 2 10	18 34	21 4	21 23
Increase due to the higher rates of fertiliser.					
...	4 3 10	8 2 21	...	2 30	2 49

MERREDIN EXPERIMENT FARM.

HAY.			GRAIN.		
75lbs.	150lbs.	225lbs.	75lbs.	150lbs.	225lbs.
cwts. qr. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
55 0 0	53 1 24	57 0 0	30 40	34 40	35 20
54 0 16	57 2 24	56 1 4	30 40	33 20	35 36
54 2 0	58 3 4	58 0 0	32 0	35 36	35 44
...	...	...	30 16	36 0	34 56
...	...	...	31 44	34 0	34 56
Average Yield per Acre.					
cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
54 2 5	56 2 17	57 0 11	31 4	34 43	35 18
Increase due to higher rate of fertiliser.					
	cwts. qrs. lbs.	cwts. qrs. lbs.		bus. lbs.	bus. lbs.
	2 0 12	2 2 6	...	3 39	4 14

The results of this single years' experiment show that the yield of both hay and grain is increased by the additional fertiliser. At Chapman the value of the increase of both hay and grain is more than sufficient to cover the cost of the additional fertiliser. At Merredin the results are not quite so pronounced though there is an increased yield. It is only in the case of the grain from the 150 lbs. application that the extra fertiliser would be justified by its cost.

It was noticed that the plots receiving the heavier dressings matured several days earlier than those receiving the lighter one.

Farmers' Results.

Similar trials were conducted by Messrs. J. D. Hammond, "Cuttening," Kellerberrin; and Teasdale Bros., "Cumberland Farm," Belka.

As with the rate of seeding experiment, the trials were on well fallowed land, and each plot was approximately ½ acre in area and was duplicated. The computed acre yields are as follow:—

Variety Planted.	Belka.		Kellerberrin.	
	Merredin. 15-5-23.		Gluyas Early. 10-5-23.	
Superphosphate per acre.	Computed yield per acre.	Increase.	Computed yield per acre.	Increase.
lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
75	32 28	...	26 43	...
150	32 45	17	27 29	46
225	33 47	1 19	29 16	2 33

In these trials, as at Merredin, though the additional fertiliser produced a greater yield, it is not sufficient to conpensate for the extra outlay involved.

In both these trials the increase from the second additional amount of superphosphate is greater than from the first. This is a result difficult to

understand, as it is quite opposed to the law of diminishing returns. Because of this the results cannot be accepted as conclusive, and it will be unwise to depart from the usual practice because of the results obtained this year.

WHEAT VARIETY TRIALS.

Tests for Productiveness.

The object of this experiment is to determine the most suitable varieties—

(a) For hay;
(b) For grain;

for the districts of similar climatic conditions to those in which the Experiment Farms are situated.

In this trial a variety regarded as suitable for the district is used as a control or standard variety, and is planted in the first plot and every fifth plot, as shown in sketch A hereunder. Each plot is repeated eight times, three being cut for hay and the remainder stripped for grain. Each plot is the width of one drill and about 10 chains long. Until this year the plots were the width of four drills and were planted in duplicate and are ranged as in sketch B.

A *The Past Season.*
Control Variety.
Variety I.
Variety II.
Variety III.
Variety IV.
Control Variety.
and so on 8 times.

B *Previous Season.*
Control Variety.
Variety I.
Variety II.
Control Variety.
Variety I.
Variety II.
Control Variety.

In addition to the control plot 12 varieties were tried. This involved the planting and harvesting of 128 separate plots.

The experience of the past season with the new method has been very satisfactory, and it is intended to continue it.

The ground for this trial is fallowed. It was brought to a good tilth by Winter ploughing and cultivation during the Spring and Summer, and was cultivated again just prior to seeding. The rate of seeding for all plots is the same, the drill being set to sow 60 lbs. per acre. Superphosphate, 22 per cent., was applied at the rate of about 100 lbs. at Chapman and about 80 lbs. at Merredin.

The results obtained and computed to an acre basis are as follow:—

Chapman Experiment Farm.

Average Yields per Acre—1923.

Seed planted May 9th-12th, 1923.

HAY.

Variety.	Section 1.			Section 2.			Section 3.			Average yield per acre.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts	qrs.	lbs.
Gluyas Early	24	1	4	26	1	20	28	1	20	26	1	15
Yandilla King	23	0	24	23	0	8	29	1	20	25	0	27
Nabawa	21	0	24	23	1	20	24	1	4	22	3	25
Gresley	26	1	4	26	3	20	29	2	0	27	2	8
Dindiloa	19	2	16	21	0	24	24	0	16	21	2	19
Gluyas Early	24	3	12	25	2	0	28	1	12	26	0	27
Comeback	21	1	4	21	3	4	24	2	16	22	2	8
S. H. J.	19	3	4	21	2	8	23	0	24	21	2	3
Toby's Tusk	19	3	12	20	3	20	24	0	8	21	2	13
Carrabin	19	2	0	20	1	12	22	2	24	20	3	12
Gluyas Early	25	0	16	25	0	16	26	1	4	25	2	3
Merredin	23	0	0	22	1	4	23	2	8	22	3	23
Florence	20	0	16	20	0	0	22	2	16	20	3	20
Gluyas Early	27	0	0	27	1	4	27	2	24	27	1	9

GRAIN.

Variety.	Sections.										Average yield per acre.	
	1.		2.		3.		4.		5.			
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.
Gluyas Early	18	26	22	13	22	40	23	6	19	20	21	9
Yandilla King	20	13	21	6	24	0	24	13	20	53	22	5
Nabawa	20	26	21	20	24	13	22	0	20	53	21	46
Gresley	22	53	25	6	26	53	24	26	24	53	24	50
Dindiloa	20	13	20	53	22	40	20	40	20	26	20	58
Gluyas Early	20	40	21	20	22	26	20	13	20	26	21	1
Comeback	17	46	20	13	20	26	18	40	18	13	19	4
S. H. J.	16	40	18	53	19	46	18	13	17	33	18	13
Toby's Tusk	20	26	22	13	24	0	22	0	20	40	21	52
Carrabin	16	0	19	46	21	33	19	20	19	33	19	14
Gluyas Early	20	53	22	53	23	6	20	53	20	26	21	38
Merredin	23	33	25	46	24	0	24	53	23	33	24	21
Florence	16	0	18	53	17	6	16	53	16	0	16	58
Gluyas Early	22	26	24	0	24	13	22	0	22	0	22	56

Merredin Experiment Farm.

Average Yields per Acre.

Seed planted May 17th, 1923.

HAY.

Variety.	Section 1.			Section 2.			Section 3.			Average.		
	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.
Gluyas Early	52	3	12	55	2	12	55	0	24	54	2	7
Gluyas Late	54	1	4	53	0	0	51	2	16	52	3	25
Federation	52	2	16	50	0	16	43	1	20	48	2	27
Hard Federation	48	3	20	52	0	0	48	3	20	49	3	23
Nabawa	44	0	24	48	2	16	45	1	4	46	0	5
Gluyas Early	58	0	24	53	1	20	53	1	20	55	0	8
Nungarin	49	2	0	46	3	2	45	3	12	47	1	20
Nangeenan	49	0	16	47	1	4	46	2	16	47	2	21
Belka	49	1	4	46	2	16	49	1	4	48	1	17
Gresley	53	0	0	53	0	8	54	3	12	53	2	13
Gluyas Early	50	0	16	49	1	20	53	3	4	51	0	13
Canberra	53	2	8	53	0	0	55	0	24	53	3	20
Carrabin	48	1	20	47	0	0	46	3	20	47	1	23
Merredin	41	1	20	48	1	12	44	2	0	44	3	1
Florence	47	0	16	48	2	8	47	0	0	47	2	8
Gluyas Early	48	1	20	49	1	4	49	0	16	48	3	23

GRAIN.

	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Average.
	bush. lbs.	bush. lbs.	bush. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
Gluyas Early	32 40	31 6	31 33	31 6	29 46	31 14
Gluyas Late	32 26	34 0	31 6	32 53	32 53	32 40
Federation	30 13	30 13	29 33	30 53	28 53	29 57
Hard Federation	26 13	28 0	26 13	28 53	26 53	27 14
Nabawa	35 15	35 15	33 0	29 46	33 45	33 24
Gluyas Early	31 6	32 40	32 13	33 46	32 13	32 24
Nungarin	27 33	23 33	25 33	28 53	26 26	26 24
Nangeenan	29 20	28 40	29 6	30 40	24 53	28 32
Belka	27 46	25 6	27 6	27 6	25 46	26 34
Gresley	28 26	28 53	30 26	30 26	28 26	29 19
Gluyas Early	31 20	32 53	34 13	31 20	32 13	32 24
Canberra	32 40	33 20	33 46	33 20	34 13	33 28
Carrabin	28 13	30 13	30 40	29 20	28 0	29 17
Merredin	33 6	34 13	32 0	34 13	31 46	33 4
Florence	22 40	22 26	22 53	23 46	24 0	23 9
Gluyas Early	32 26	31 33	31 20	31 46	32 0	31 49

The following particulars concerning two experiments made by Mr. A. M. Richardson, of "Claverly," Red Lake, on the Esperance Railway, will be of interest. The object of the experiments was to finalise some tests on growing "shandy" hay—wheat and oats intermixed. In the first experiment, Sultan wheat and Sunrise oats were planted at the rate of 40lbs. each per acre. They reached the hay stage at exactly the same period, and were both tall growers, with a nice fine straw which made excellent chaff. In the second experiment, Fortune wheat at the rate of 30lbs. and Lachlan oats 50lbs. to the acre were planted. These were well matched as regards maturity and height, but were not as tall as the first mixture. The chaff, which was of a purple colour, was equally good. Both mixtures were greatly relished by the horses. No. 1 mixture cut 35cwt. to the acre, and No. 2 32cwt., but as No. 1 is ready to cut about 10 days earlier than No. 2, a greater area can be cut at the right stage. Wheaten hay only cut about 30cwt. per acre. These returns must be considered fairly satisfactory, as the season in that district has not been a good one.

Tests of early and late sowings of wheat were also made by Mr. Richardson in 1922, and the figures supplied by him show the results to be as follow:—

	Sown 21-4-22.	Sown 5-6-22.	Mean yield per acre.
	bus. lbs.	bus. lbs.	bus. lbs.
Nabawa	19 35	17 15	18 25
Sultan	18 32	17 32	18 2
Fortune	19 10	12 0	15 35
Emperor	15 25	13 45	14 35

A small plot of Gallipoli wheat sown on 12th May at the rate of 20 bushels 10 lbs. per acre.

A New Journal.—Among the exchanges which have been received during the past month is the first issue of "Tropical Agriculture," a journal issued by the Imperial College of Tropical Agriculture, Trinidad, West Indies. It contains 16 pages of well-printed matter dealing with Tropical and Chemical Research, Entomology, and other matters of interest to the student of tropical science. The journal is printed by the Government Printer, British West Indies.

BUY GOOD SEED.

Advice to Farmers.

W. M. CARNE,
Botanist and Pathologist.

The attention of farmers is drawn to the operations of the "Agricultural Seeds Act." Under it all vendors of seed are required to supply with each parcel of seed sold, or exposed for sale, a statement as to its name, germination and purity. This statement is a guarantee that the germination shall not be less, or the amounts of impurities or weed seeds greater, than as stated *at the time of sale.* It does not apply to farmers who sell seed to seed merchants.

By "Germination" is meant the percentage by number of pure seed which will germinate normally. "Impurities" refers to dirt, damaged, diseased or insect infested seed, empty husks of grasses, smut balls, ergots, etc. "Weed seeds" include all seed other than the kind which the parcel is stated to be on the guarantee. Impurities and weed seeds are stated as percentage by weight of the parcel.

In the case of lucerne, the country or State in which it was grown must be stated.

In legumes, such as clovers and lucerne, the percentage of hard seeds (good seeds which will not germinate under normal conditions) is not to be included in germinable seeds, but should be stated separately.

As no standards for seeds are enforced by the Act upon the vendors, it follows that a certain responsibility is thrown on the purchaser if he desires to buy seed of good quality. Therefore, *look for the guarantee when buying.*

The value of good seed is self evident. It means that less seed is required for sowing, and good clean stands and vigorous plants are more certain. Poor seed means a poor stand, unless extra heavy sowings are made, weakly plants and weedy crops.

Cheap seed is usually poor seed.

Cheap seed is expensive. Good seed deserves a good price.

Many weeds are not noxious: nevertheless their presence in crops is detrimental. Unfortunately, in some cases it is almost impossible to remove all weed seeds from crop seeds.

Buy seeds which contain little or no weed seeds and avoid getting the paddocks dirty.

The sale of seed containing certain noxious weed seeds, such as dodder and thistles, is absolutely prohibited.

Avoid lucerne seed containing pink seeds. Samples of lucerne containing pink seeds should be avoided. Their presence indicates that the seed is not Australian, or that it has been adulterated with imported seed. Under the Quarantine Regulations a certain percentage of all imported lucerne seed must be stained with rouge so that it may be readily recognised. Imported seed is not equal to Australian.

If seedsmen are suspected of selling seeds not equal to their guarantee, or containing noxious weed seeds, the Department of Agriculture should be informed so that action may be taken.

Legal action can only be taken in respect of seeds, samples of which have been taken in the presence of the vendor or his agent by an Officer of the Department.

Action cannot be taken on samples from seed purchased by a farmer after delivery has been accepted by him.

STANDARDS FOR GOOD SEED.

As a guide to the recognition of good seed, and for the better understanding of seedsmen's guarantees, the following table is published giving the germination and purity to be expected of good average seed.

Compare these figures with those guaranteed by the seedsmen. If the purchaser cannot see the seed before purchasing, he should ask for guarantees before buying.

Seed.	Germination. Per cent. of pure seeds by number.	Impurities. Per cent. of parcel by weight.	Weed Seeds (Other than noxious weeds). Per cent. of parcel by weight.
Barley	80	1	½
Beans	70	1	...
Beans, Broad	65	1	...
Beets (of clusters)	55	1	...
Borecole	60	1	...
Brussels Sprouts	60	1	...
Broccoli	60	1	...
Buckwheat	70	1	...
Cabbage	65	1	...
Carrot	50	3	...
Cauliflower	60	1	...
Celery	45	2	...
Chicory	60	2	½
Clovers, Berseem	60	1	1
Clovers, Subterranean, Cowgrass, Crimson	65	1	½
Clovers, White, Alsike	65	1	1
Clovers, Strawberry	35	1	1
Clovers, Bokhara, Hubam, King Island	20	1	1
Cotton	65	2	...
Cowpea	75	1	...
Cress	55	1	1
Cucumber	65	1	...
Grasses—			
Rye Grass	55	30	½
Cocksfoot	50	30	½
Danthonia	30	50	½
Kentucky Blue	35	50	½
Sudan	70	3	½
Johnson	40	3	½
Paspalum	20	65	½
Prairie	55	25	½
Rhodes	35	50	½

Seed.	Germination. Per cent. of pure seeds by number.	Impurities. Per cent. of parcel by weight.	Weed Seeds (Other than noxious weeds). Per cent. of parcel by weight.
Kale	55	1	...
Kohl rabi	55	1	...
Leek	45	1	...
Lettuce	65	½	...
Linseed	75	1	1
Lotus spp.—Giblet's Grass, Lotus Major, Boyd's Clover, Birdsfoot, Trefoil	60	1	1
Lucerne	75	1	½
Mangel	55	1	...
Maize	85	1	...
Marrow	65	1	...
Medicago spp.—Burr Clover, English Trefoil	65	1	1
Melon	60	1	...
Millet	70	1	½
Mustard	70	1	...
Oats	80	1	½
Onion	55	1	...
Parsley	45	1	...
Parsnips	25	2	...
Peas	75	2	...
Peanuts	65	2	...
Popcorn	75	2	...
Pumpkin	65	1	...
Radish	60	1	...
Rape	70	1	½
Rice	80	1	½
Rye	80	1	½
Sheep's Burnet	55	2	½
Sorghum	70	2	½
Spinach	45	1	...
Spinach (Silver Beet)	55	1	...
Squash	65	1	...
Sunflower	55	1	...
Swede	65	1	...
Sweet Corn	75	2	...
Tares	75	2	½
Tobacco	55	1	...
Tomato	65	1	...
Turnip	65	1	...
Vetches	75	2	½
Wheat	80	1	½

NOXIOUS WEED SEEDS, THE SALE OF WHICH IS PROHIBITED.

Ambrosia spp.; *Argemone mexicana* (Mexican Poppy); *Asperula azurea*; *Asphodelus fistulosus* (Onion Weed); *Carduus spp.*; *Carthamus spp.*, *Centaurea spp.*, *Cnicus spp.* (Thistles); *Cuscuta spp.* (Dodder); *Cucumis myriocarpus* (Paddy-melon or gooseberry cucumber); *Cyperus spp.* (Nut Grass); *Datura stramonium* (Thorn Apple); *Echium plantagineum* (*violaceum*) (Paterson's Curse); *Emex australis* (Double Gee); *Euphorbia*

terracina (Carnation weed); *Gilia squarrosa* (Californian Stinkweed); *Gomphocarpus fruticosus* (Cotton bush); *Guizotia abyssinica; Homeria collina* (Cape Tulip); *Hypericum perforatum* (St. John's Wort); *Inula graveolens* (Stinkwort); *Kentrophyllum lanatum* (Saffron Thistle); *Lapsana communis* (Nipplewort); *Onopordon sp.* (Thistle); *Opuntia spp.* (Prickly Pear); *Salsola kali-tragus* (Russian Thistle); *Solanum sodomaeum* (Apple of Sodom); *Solanum rostratum* (Buffalo Burr); *Sonchus arvensis* (Perennial Sow Thistle); *Trypteris clandestina* (Stinking Roger); *Tussilago farfara* (Coltsfoot); *Xanthium spp.* (Burrs).

FEES FOR TESTING SEEDS.

Farmers and others can have samples of seeds tested by the Botanist on payment of the undermentioned fees:—

Germination examination	2s. 6d.
Purity examination	5s. 0d.
Purity and Germination	6s. 0d.

For mixtures, double the above fees.

Samples of seed sent in for testing should not be less than the weights stated as under:—

Wheat, oats, barley, maize, rice, rye, cowpeas, tares or vetches, peas, beans	8 ozs.
Lucerne, sorghum, clover, Sudan grass, millet, linseed, Canary grass, Prairie grass, buck wheat, cotton ..	4 ozs.
Grasses, and all other agricultural seeds	2 ozs.

The samples should be a true sample of the bulk from which they are drawn.

RUST OF CEREALS.

W. M. Carne, Botanist and Pathologist, and J. G. C. Campbell, B.Sc., Assistant.

1.—STEM RUST OF WHEAT AND BARLEY.

(*Puccinia graminis* var. *tritici.*)

Stem Rust, known also as Black or Summer Rust, is a disease resulting from the attacks of a parasitic fungus known as *Puccinia graminis.*

Wherever wheat is grown Stem Rust occurs. So serious are the losses resulting from its attacks that, of all known plant diseases, it is generally considered to be the most important, and more attention has been given to its study than to that of any other of the many ills to which plants are subject.

The occurrence of rust to a serious (epidemic) extent is closely related to climatic conditions, and, in many countries where such conditions are apt to be favourable, the disease has become a definite limiting factor in the production of wheat for grain. In New South Wales, rust has made the growing of grain on the coastal areas unprofitable, and its outbreak in the

early days of the settlement stimulated the exploration and development of the back country.

It is hard to determine the exact amount of loss due to any plant disease, but the following figures will give some idea of the serious depreciation in crop values which rust may cause. It has been estimated that in 1916, in the United States, the disease caused a loss of at least 280,000,000 bushels, which was equivalent to about one-third of the crop. In 1920, in Minnesota (U.S.A.), 60 per cent. of the crop was lost. The epidemic year of 1916 is said to have cost New South Wales more than £2,000,000.

Fortunately, Western Australia suffers less from rust than any other of the Australian States. Serious loss occurs only rarely. In fact, during the last twenty years, on only two occasions has the disease assumed serious proportions—in 1915 and, to a lesser extent, in 1917.

The district which suffers most is the Midland-Geraldton-Northampton area which, from its situation near the sea, is more humid than the wheat belt proper. In normal years any loss which occurs from rust is so insignificant as to pass unnoticed, and, indeed, so uncommon is it that considerable difficulty is experienced in obtaining good specimens.

Symptoms.—The first indication of the presence of rust is the appearance, principally on the stems, but also on leaf sheaths and leaves, of elongated reddish-yellow spots. On close examination, these spots will be found to be raised above the surface of the leaf like a small blister. Eventually, the skin bursts, exposing to view a narrow, elongated, powdery, reddish mass surrounded by the ragged edges of the pustule. The apparent resemblance of the latter to iron rust has earned for the disease its popular name. Each of these rusty-looking spots is known as a *pustule* or *sorus*. Under favourable conditions, the pustules rapidly increase in numbers, and may spread to the ears.

Later in the season black pustules appear amongst the red ones, especially on the stem. From these, the disease derives its name of Black Rust. This stage is known also as Stem Rust and Summer Rust. It should be clearly understood, however, that the black and the red pustules, although different in appearance, are really only different stages of the one fungus, and do not represent two different diseases.

The red pustules are the more plentiful when the plants are green, the black appearing and gradually predominating as they ripen off towards harvest.

Damage done to Crops.—The amount of damage done to the crop is proportional to the number of pustules present, and to the earliness of the attack. If the disease appears while the plants are yet young the result may be serious; if, on the other hand, it does not attack until they approach maturity, the effects may be negligible.

The parasite weakens the plants by utilising the food which otherwise would contribute to their growth and, later, to the formation of the grain. This food it can obtain only from the living plant cells. In susceptible wheats, the cells are not affected by the presence of the fungus, and go on functioning as usual. In resistant plants, on the contrary, the cells die wherever the parasite attacks, thus cutting off the food supply of the latter and causing it, in turn, to die of starvation.

The extent of the damage also varies. In the worst cases, the crop may be a complete failure. In rather less severe attacks, the grain, although formed, may be pinched and small, and unsuitable for milling, and the plants

may be stunted. The yield of hay is then reduced, although the quality is not deleteriously affected as regards food value. However, the spore dust which arises from it is liable to cause irritation of the nasal mucous membranes of the stock to which it is fed. This may be obviated by previously damping or steaming the fodder.

Life History of the Fungus.—The red dust pustules contain a loose powder which, in bad attacks, rises like a cloud of dust when the plants are shaken. This powder consists of minute, oval, reddish-brown bodies about one-thousandth of an inch in diameter. These are the spores or seed bodies of the fungus, and are known, technically, as *uredospores* (Fig. 1). They are

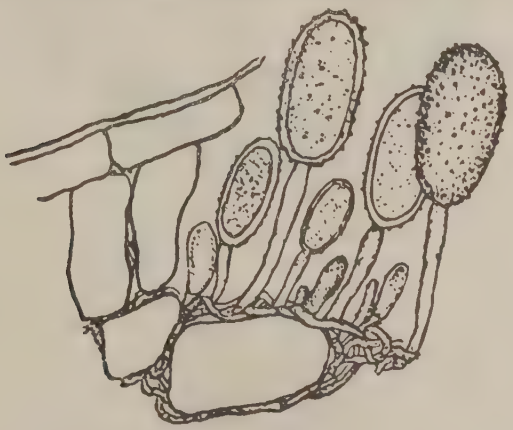


Fig. 1.—Wheat Rust: Clusters of uredospores. breaking through skin of leaf (after Duggar).

the cause of the rapid spread of the parasite from one part of the plant to another, or from plant to plant. When these uredospores are placed in a drop of water they germinate (Fig. 2), producing one or more thread-like

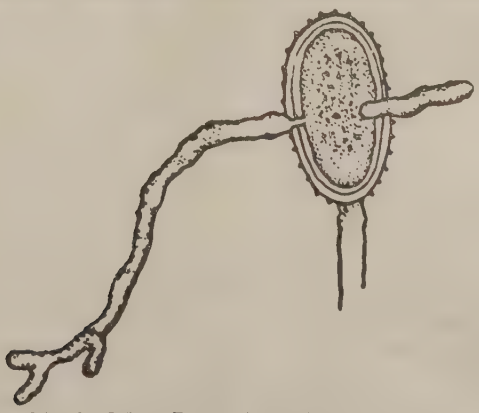


Fig. 2.—Wheat Rust: A germinating uredo or summer spore (after Duggar).

outgrowths which are known as germ-tubes. Under ordinary circumstances, the growing spore now dies. If, however, the water in which it is growing is on a wheat plant, the germ tubes enter through the breathing organs (*stomata*) (Fig. 3) of the leaf or stem, and grows amongst the cells of which

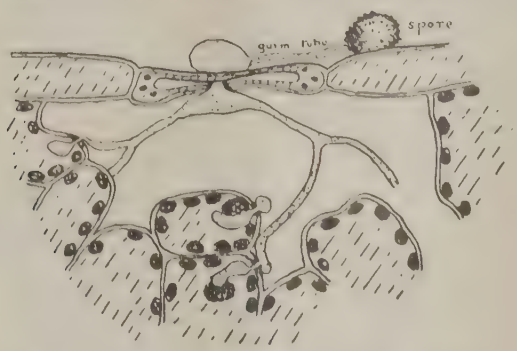


Fig. 3.—Wheat Rust: Infection of leaf by uredospore through stomata on leaf (after Osborne).

the plant is constituted. From these cells they absorb the food of the plant, and flourish at the expense of the latter, which is now known as *the host*.

After growing in the host for about ten days, the fungus is ready to form spores. These are developed just beneath the surface of the stem. As they mature, the outer layer of cells (*epidermis*) becomes pushed out and, finally, is burst open, exposing to view the reddish spores beneath, and thus forming the typical rust pustule. The spores are blown about by the wind and, eventually, some of them lodge in a film of water on the same or another wheat plant, germinate, and cause infection as just described.

After the pustule opens, spores are continuously formed and distributed. Consequently, new infections are always taking place, and new pustules appearing. The number of spores liberated, and, therefore, the number of new infections, steadily increases as the season advances, until, finally, the attacks occur so frequently that the plants are unable to maintain themselves against them. The result is a more or less complete failure of the crop.

Fortunately, in Western Australia, suitable conditions occur only occasionally. The essential factor for the spread of rust is moisture, and this must be accompanied by warmth. The disease is most prevalent, therefore, during sultry weather (when the air is charged with moisture), in damp situations, or following after rain or heavy dew. The humid atmosphere prevents the too rapid evaporation of the water from the plants, thus giving the uredospores place and time to germinate and enter the host.

The freedom of Western Australia from rust in the wheat growing areas is due to a great extent to the general absence of muggy weather in the spring and early summer. Nevertheless, the little rust which does occur is sufficient to ensure the presence of spores to start an epidemic when favourable conditions do occur during the growing season.

Rust may appear in the autumn or during mild winters, but usually, it is during the spring and early summer that it is most prevalent.

As the plants begin to ripen off, the red pustules on the stem are replaced by black ones. These black pustules contain spores of another type which, individually, are dark brown in colour but in mass, appear black. These spores are larger than the red ones, are two-celled, and are known as *resting spores* or, technically, as *teleutospores*. (Figs. 4 and 5.)

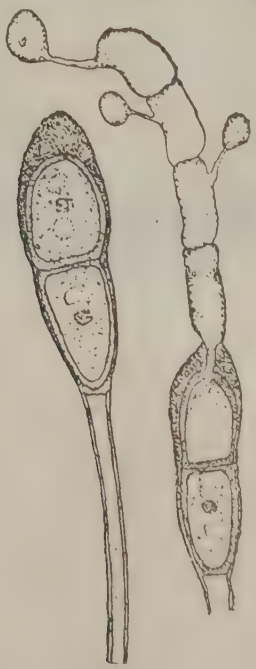


Fig. 4.—Wheat Rust: Teleuto or "Resting" spores. On the right the two-celled spore is shown after germination with the secondary spores growing from three sections of the germ tube (after Duggar).

A new variety of kidney bean has been raised by a lady graduate of the Melbourne University. It differs in its pods, which are dark red, but boils the same colour as the ordinary French bean. It is as productive as the latter, but much more drought resistant, and stands hot dry winds which shrivel up the foliage of other varieties. The new variety has been named the Botany Bean, and will be put on the market next year, when sufficient seed shall have been grown.

Fig. 5.—"Wheat Rust": A cross section of a wheat stem showing "teleuto" spores formed and the extent of damage on a badly infected plant.

Wheat rust probably originated in a country possessing a cold climate, and the various stages of its life history were developed accordingly. In the colder parts of Europe and North America, the red spores cannot survive the severe winter. The black spores, on the contrary, will not germinate unless they are previously exposed to intense cold. Formed during the summer, they lie wherever they fall until the following spring. They then germinate, producing a short germ tube on which are produced four spores of a third type—*sporidia*. These sporidia cannot parasitize wheat plants. They will grow only in a few species of a totally different plant known as the barberry. After growing on this plant for a time a fresh lot of spores are formed. They appear on the upper surface of the leaf, and differ in appearance from either of the three types previously described. Spores of this fourth type are known as *spermogonia* or *pycnospores*, and take no further part in the development of the rust. Accompanying the spermogonia, but appearing in special cup-like structures known as *cluster-cups* or *aecidia* on the under side of the leaf, is a fifth type of spore, the *aecidiospore*. These aecidiospores will germinate and attack, not another barberry, but a wheat plant, setting up typical rust which soon produces uredospores.

This part of the development by means of teleuto- and aecidiospores does not occur in Western Australia for two reasons. The first is that the barberry does not occur here (except occasionally as a garden shrub); the second is that the temperature is not low enough to give the teleutospores the requisite period of cold. The latter spores, therefore, are of no practical importance under Australian conditions, although Mr. Waterhouse, of Sydney University, has shown that, under suitable conditions, they will function as they do in cold countries. This he did by experimentally producing the characteristic cluster-cups on barberry plants by means of teleutospores

from wheat which had been exposed to the cold winter of Glen Innes, in the New England District of New South Wales.

How the infection is carried over from season to season.

In Australia, rust usually does not appear before the spring. So far, it has not been satisfactorily explained how the disease survives from harvest to the following spring. Three methods have been suggested, and each of these has some evidence in its favour.

1. It is possible that sufficient red spores survive in sheltered places to start the disease again when a favourable opportunity occurs. With a short period of suitable weather, these few would quickly reproduce millions; rust again would be in evidence, and would be spread quickly and widely by the wind, which is known to carry spores for many miles.

2. The rust might survive on self-sown, out-of-season wheat or barley. This is more probable in the Eastern States, which have summer rainfall, than in Western Australia.

3. *Puccinia graminis* attacks other cereal and many grasses. This suggests that these plants may carry over the fungus when wheat is not grown. The fact is, however, that there are several races of the rust which, although to all appearances identical, will attack only certain definite groups of plants and no others. For example, *Puccinia graminis*, variety *tritici*, will attack wheat, barley, rye and, to a slight extent in other countries, certain grasses, but will not attack oats. Oats, on the other hand, is infected with another race, *Puccinia graminis*, variety *avenae*, which will not attack wheat. In Australia, no grasses have been found attacked by *P. graminis*, var. *tritici*, and, therefore, this theory has, at present, little to support it.

Control.—In countries where the barberry plays an essential part in the life history of the fungus, the destruction of this plant assists materially in the elimination of the disease.

In Australia, where the barberry does not grow wild, and where it is not essential for the fungus, the problem of control becomes much more difficult. Climate, the principal factor governing an epidemic, is beyond control. No direct method of attacking the fungus has been yet devised. The alternative is to grow wheats that will be approaching maturity when the rust is becoming epidemic, or to grow varieties which are resistant to the parasite.

The former of these objects is best attained by growing early maturing varieties which, under normal conditions, are sufficiently advanced in growth to be beyond danger of serious damage at the ordinary season for rust. Such wheats include the principal varieties grown in Western Australia, the relatively short season rendering the slower maturing sorts unprofitable. This method is somewhat uncertain, because rust in some years appears unusually early. If the crops are planted still earlier to avoid this possibility, they may fail from premature heading in cold or wet weather.

The most certain way of avoiding injury from rust is to use resistant varieties of wheat. Since the time of Farrer, of New South Wales, wheat breeders the world over have been devoting special attention to the production of such varieties. Their efforts so far have been only partially successful, as it was found that varieties which, in one place, were resistant would be

in another place highly susceptible. The explanation of this behaviour has been found in recent years, by Professor E. C. Stakman and his colleagues, of Minnesota, U.S.A. These investigators have shown that *P. graminis* var. *tritici* consists of a number of strains, each of which attacks only certain varieties of wheat; and that a wheat which is resistant to one strain is not necessarily resistant to any other. These strains are known as *biologic forms*. Thirty-seven of these have been isolated in America, but only two so far in Australia. In breeding a resistant wheat for a given district, it is essential, therefore, to know the forms of rust that exist there, and to select the plants which resist these. This involves the determination of the distribution of the forms. This is being done, for Australia, by Mr. Waterhouse, of Sydney University. So far, only one form is known from this State; possibly, it is the only one. This, if so, would account for the general immunity of the Departmental wheats such as Nabawa, for, if only one form of rust exists, it necessarily follows that a variety bred at Chapman (in the centre of the rust area) to resist that form will be resistant in any other part of the State.

2.—STEM RUST OF OATS.

(*Puccinia graminis* var. *avenae*.)

This disease occurs in the South West of the State, but is by no means as serious as the Stem Rust of Wheat. It occurs both on cultivated and on wild Black oats.

3.—LEAF RUST OF OATS.

(*Puccinia lolii-avenae*.)

This is common both on cultivated and on Black oats. The damage done does not appear to be very serious. It is essentially a leaf disease, even the black teleutospores being formed on the leaves.

4.—LEAF OR SPRING RUST OF WHEAT.

(*Puccinia triticina*.)

This disease has not been recorded from Western Australia, so far. It is common in the Eastern States, but it is not considered to be as serious as the Stem Rust. The pustules occur principally on the leaf blades.

5.—LEAF RUST OF BARLEY.

(*Puccinia simplex*.)

Like the Leaf Rust of Wheat, this disease has not been recorded for Western Australia up to date.

The life histories of the Leaf Rusts do not differ, generally, from that of the Stem Rust.

The secondary host for Wheat Leaf Rust is Meadow-rue (*Thalictrum* spp.); for Oat Leaf Rust it is Buckthorn (*Rhamnus* spp.). These plants take the place of the barberry in Stem Rust. The æcidial stages are, however, not known in Australia.

CULTIVATION OF THE POTATO.

Soils and Locality.

G. N. Lowe,
Senior Potato Inspector.

With such a number of new settlers now making their homes in the South-West, which is our recognised potato growing country, advice as to what class of soil and the locality for the successful growth of a potato crop, whether just for home use or as a means of livelihood, should be of interest. It is assumed that the greater proportion of readers of this and subsequent articles on the cultivation of the ubiquitous "spud" are quite new to the various operations in connection with its growth.

The potato will grow in almost any class of soil from sand to clay, but the ideal is a rich loam, freely drained for the winter planted crop, which is at present outlined. The summer crop requires different conditions, and will be the subject of a later article.

Before the soil is finally decided upon it is wise to avoid any locality where frost is likely to occur, as a promising crop may be ruined by this means. For this reason a westerly slope should be selected if possible, as even with the crop covered with frost the warming atmosphere will generally disperse it before the direct rays of the sun can strike the plant and cause sudden thawing, this being what causes the damage. It may be well just here to explain roughly how frost bite on plants is brought about. Much, of course, depends on the stage of growth, a sappy tender growth being much more susceptible to damage than a hardened woody condition of the plant.

As the temperature falls to about freezing point the plant saps are drawn out of the plant cells in the form of pure water and frozen eventually. With a gradual thawing the cells have the power to re-absorb this water and damage is averted. Should the thawing be sudden, however, this essential water is not re-absorbed, and death takes place almost as though the plant were drought stricken, or burnt by the sun, the lack of moisture in either case being the cause of death.

A small garden plot of potatoes or other plants may often be saved from damage when frost is noticed on them by watering with ice cold water, which brings about a gradual thawing.

Having decided then on the locality and the soil the next operation is the first plowing, assuming that new or virgin land is to be used. Necessarily the land will be very rough after this operation, which should be as thorough as possible, and to a depth of 8 or 9 inches.

Fallowing for potatoes is just as necessary as for any other crop, and though often good results are obtained by planting soon after the initial plowing, or even at that time, it is hardly reasonable to expect a soil which has for centuries lain in an acid condition under timber to furnish a return equal to that soil which has had the sweetening influence of sunlight and air for a season. For this reason prospective potato growers are strongly advised to break up their paddock the winter preceding and leave it in the rough state, working it down the following winter in time for planting.

Deep thorough plowing for potatoes is essential, not only from the standpoint of conservation of moisture, but for the reason that the potato rootlets have no great penetrative power, and so the depth of nicely friable soil to allow of proper and adequate root expansion is an important feature of cultivation for this crop.

However careful the clearing of the land may have been a percentage of roots and burnt off stumps will be found by the plow, and much damage to implements and annoyance will be averted should these be removed at once.

The "lands," *i.e.*, divisions of the paddock by the plow from finishing furrow to finishing furrow, should not exceed 11 yards at any time, and in a wet locality 8 yards will allow of much better drainage, and assist materially in the warming of the soil, which is to be sought after in the winter planted crop.

POTATOES.

Seasonal Notes.

G. N. LOWE,
Senior Potato Inspector.

With the summer planted crop now well above ground, the chief operation is that of keeping couch grass and weeds down. The bulk of this work must be done by hand-hoeing, as it is not wise because of the long dry season to disturb the surface unnecessarily as would be the case with horse implements and so release any of the moisture still retained in the soil, Where irrigation is followed the horse cultivator may, of course, be used.

Due to the long dry spell Potato Moth (commonly called the "Fly") has appeared in the tops, and is likely to cause much damage if not combated. The system of Night Light Traps is at once the simplest and most effective way of dealing with this pest, but growers generally are far too inclined to trust to luck to escape loss by the attack of Moth.

Now is the very best time for growers to make a determined effort to fight this pest, as the last long wet winter certainly kept the trouble in check very considerably, and this season furnishes an opportunity to attack the Moth when reinforcements are low.

The essentials in the production of clean milk are as follows:—Cows must be healthy (no wasters). Shed clean, well lighted and ventilated, and surroundings clean. Any operation producing dust just before or during milking must be avoided. Cows must be clean; water washings give best results. After washing, wipe udders and teats with clean damp cloth. Milkers' hands, clothes, and stool must all be clean. Milk pail should have a small opening. The first stream of milk from each teat should be rejected. Milk removed from cowshed at once and strained. Milk must be handled in clean, airy, well-lighted shed, kept solely for this purpose. Milk must be cooled to 50 degrees F. where possible. Milk utensils, including cooler, rinsed with cold water immediately after use, afterwards washed and scrubbed with hot water, then rinsed in clean water and sterilised by steam. Scalding will not sterilise.

POULTRY ON THE FARM.

G. Allman,
Government Poultry Expert.

Poultry-keeping is a branch of agriculture which may be carried on with success under most varied conditions either on the broad areas of wheat farms, the smaller acreage of orchardists, or in the city and suburban dwellers' back-yards. Provided the right class of fowls are kept and given proper care and attention, they will return a profitable harvest throughout the year, irrespective of rainfall or adverse climatic conditions. No other farm crop can be brought into profit so quickly as poultry or give better returns on capital outlay.

Farmers and all settlers on the land should keep fair-sized flocks of fowls, if only to supply the household requirements. This reduces the household expenses, and provides a nutritious and palatable food which is always handy for immediate use, whether for breakfast, dinner or tea.

Generally speaking farmers do not seriously consider the question of poultry breeding. They are content to let the flock run and breed together, paying no attention to selection of the breeding stock, with the result that type and standard are lost, and the flock soon degenerates, no two birds being alike in type or colour, and their laying capabilities greatly diminished or lost.

Climatic conditions are ideal in Western Australia for poultry-rearing. They may be kept successfully and profitably in the dry areas of the Eastern Goldfields, or in the wetter and cooler climate of the South-West. It is simply a matter of which breed best suits the district. Big heavy-framed birds will do better in cooler districts than in the warm wheat-farming localities.

Perth being the principal market for poultry products, it is obvious that farmers living any great distance away cannot hope to successfully compete with nearby commercial poultry farmers. It is true that with the advantage of cheaper land and feeding he can produce eggs and poultry much cheaper than the city man, but the great distance from markets and the heavy freights are a severe handicap. There is also a considerable difference in the price of eggs produced by the commercial poultry-keeper and those of the farmer. This is accounted for by the guarantee that is given by the commercial poultry-keeper that every egg he sends to market is reliable, and may be used for the breakfast table, while as a general rule country eggs can only be used for manufacturing purposes. It is for the farmers themselves to alter this state of affairs. If they keep the right class of fowls, give them proper care and attention, pay particular care to gathering and marketing the eggs, keeping back all those that are small or doubtful, and sending regularly to market, his products will soon become known and sought after at satisfactory rates. The value of poultry on the farm lies not only in the direct return they bring in, but in the increased value they give the land. In comparison no other farm stock voids such a quantity of valuable manure as a fowl. It is estimated that the domestic hen will produce up to 200lbs. of manure per annum, and the high percentage of nitrogen and ammonia it contains makes it the most valuable of all fertilisers for any kind of crop.

KEEPING FOWLS ON THE COLONY SYSTEM.

This method has many advantages over the small runs or yards. Where shelter is available and space ample, there is no limit to the number of flocks that may be kept in close proximity. The labour required for attendance is reduced to a minimum, and the outlay in erection of yards is obviated.

The colony system simply means that fowls are allowed to range at will over the land, a house being provided for them to roost in at night. A colony may be composed of any number of fowls, but if the houses are to be removed from time to time 100 hens should be the limit of a colony, otherwise the house will be too cumbersome for easy removal. The dimensions of a house to accommodate 50 hens should be 12 feet long, 6 feet wide, 5 feet high in front, and 4 feet at the back with three perches. The front should be enclosed with netting to protect the fowls from night pests, also to keep the birds confined while being shifted to a fresh location. Houses should be so constructed that when required to be removed they may be tilted up, a platform on wheels placed underneath, and, at night, when the birds have gone to roost, removed into the required position. A small collapsible run should be attached to the front of house for a few days after the house is shifted on to fresh ground, or when a new colony is formed, to allow the birds to become accustomed to their surroundings. For convenience of attention, the houses should be placed in rows, a distance of two chains apart, and should face the east.

On new or lately harvested ground, fowls will pick up a lot of food themselves, and thus save the cost of feeding. But the farmer must not rely too much upon this. He must see to it that they are never short of food. This is where the value of

HOPPER FEEDING

comes in. Hoppers should be of sufficient capacity to only require filling, say, once a week, and each should stand equi-distant between the four houses, thus serving four colonies. Hoppers should be built with divisions in which various kinds of foods, such as wheat, oats, barley, or any other cereals grown on the farm may be placed. One division should contain animal food of some kind. The object of the divisions is to allow the fowls to balance their own ration. It may be thought that, if animal food is always before them, they will eat a surfeit of it and leave grains alone, but such is not the case. They may for a few days eat a lot of some particular food for which their system craves, after which, if proper foods are available, they will balance their own ration.

Of late years a system of dry mash feeding has been greatly availed of by breeders. The mash is composed of the same component commodities as would be used if wet mash was given. Wet mash must be used immediately after mixing, otherwise is sours, and is likely to set up bowel troubles, and other complications, whereas dry mash may be mixed and placed in hoppers, and is available for the fowls at all times. It is a debatable question whether wet or dry mash is the best system for egg production, but there is no question that dry mash feeding is a great labour saving method.

A dry mash properly constituted and consisting of a variety of foods is much more palatable than grains alone, therefore fowls eat more of it, and consequently lay a greater number of eggs. The point for the farmer

to consider is whether the extra number of eggs obtained will compensate for the extra cost of feeding. The food composing the mash must be purchased, whereas in grain feeding it may be grown on the farm.

To keep fowls in good condition and to obtain eggs all the year around, it is essential that the birds should be supplied with animal and greed food, diets which are sometimes difficult to obtain on the average farm. These are preferable in a fresh state, but when unobtainable poultry meats, manufactured expressly for the purpose, and finally chaffed lucerne are excellent substitutes. There is no excuse for poultry-keepers being short of these essentials, as they are stocked by most merchants and will keep indefinitely.

Dry Mash Mixture for Hopper Feeding.

Bran	50 lbs.
Pollard	50 „
Ground Oats	50 „
Meat Meal	25 „
Oilcake (Ground)	25 „
Lucerne, finely chaffed	25 „
or	
Lucerne Pollard	20 „
Common Salt	½ „
Sulphur	½ „

Sharp hard grit and a plentiful supply of clean water must be always available to the fowls. If the water is not protected from the sun and kept in a cool place, it is likely to set up bowel troubles and other complications.

If no natural shade is available it must be provided by artificial methods. A light framework covered with bushes or bags will suffice. It will be advisable to cover in the weather side of the shelter with the same material, as strong winds are most injurious to fowls of all ages.

HOW TO START.

As most of the heavy laying strains of fowls are non-sitters, incubators are necessary, and if a large number of chicks are to be raised in the early season, considerable outlay is required for the purchase of incubators and a suitable building to accommodate same. This expenditure and the care and worry, and possibly bad hatching results, are greatly lessened if a commencement is made with day old chickens. There are several large plants in the State which cater extensively for this class of trade, and as they have first class stock and are thoroughly reliable, farmers need not hesitate about sending to them for chicks. Starting with day old chicks, a flock may be built up cheaper and quicker than by any other method.

When hens are relied upon to hatch out chicks they very often do not become broody until too late in the season to allow of a profitable flock being built up. The profitable fowl, either male or female, must be early hatched. Heavy breeds should be hatched during the May to August period, light breeds one month later. Pullets hatched during these months will be in full lay when eggs are at top prices, and will continue laying for a full year, whereas pullets hatched during November and December will miss the months of high prices, and usually stop laying and go into moult while the early hatched birds are still in full lay. Early hatched cockerels are always in keen demand for table purposes at high prices; if hatched late they are a drug in the markets, and seldom pay the cost of rearing them.

Day old chicks do not require food for at least 36 hours after hatching, that is the reason they safely travel long distances when sent direct from the incubator, distances which would kill them if sent when a few days old. Nature has so ordained that when the chicken leaves the shell its digestive organs contain a considerable amount of unabsorbed yolk, and until this is thoroughly digested and absorbed into the blood, the chicken's delicate stomach is not ready to receive other food. No set rule can be observed as regards the time chickens should receive their first meal. We must be guided by climatic conditions. In cold weather 36 hours is soon enough. In hot weather they may safely be kept without food for 60 hours.

Western Australia holds the record for long distance travelling by day-old chickens, as they have on several occasions been transported by train, motor, and aeroplane to the North-West, a distance of over 2,000 miles. The chickens arrived at their destination safe and sound, with no after ill effects, and they have since thrived well.

BROODING CHICKS.

Brooders of some kind are absolutely necessary to rear incubator-hatched chickens, therefore when day-old's are purchased proper brooder appliances should be ready to receive them. The success of poultry-raising depends more upon successful rearing of young stock than any other detail connected with the business. Chickens should be so treated that growth is rapid and good bodily development assured. Too much or too little heat will so weaken their constitution that they will always remain weedy and unprofitable birds. There are numerous methods of brooding, the principal features being the same in all cases, viz., the supply of warmth and comfort. On large comercial poultry plants brooders in general use are coke-heated, and capable of accommodating up to 1,200 young birds. These brooders are round, thus preventing crowding. Small brooders of the same type, heated by kerosene and capable of accommodating 50 chicks are also in general use. On account of cheapness, simplicity, and general effectiveness, these brooders have much to recommend them, and it will be far more profitable for a beginner to purchase these machines than trouble about making brooders himself. Home-made brooders are seldom satisfactory. If lamp-heated, they are liable to become over heated, and as there is generally insufficient ventilation provided chicks are liable to be suffocated with the fumes. Fireless, or cold brooders, are sometimes used with success when only small numbers of chicks are run together. This method consists of a box into which is fitted a pillow-shaped hover, which is just high enough to touch the backs of the chicks, under which they nestle for warmth.

Whatever style of brooder is used is should be installed in a dry house or shed free of draughts and of sufficient size to confine the chicks during inclement weather. Runs should be provided to which the chicks will have free access while the weather is fine.

The following points are essential for successful rearing:—

Plenty of sunlight.
Roomy hovers.
Plenty of space for exercise.
Good ventilation, without draughts.
Easy maintenance of uniform temperature.
Convenience in caring for and attending to the chicks.
Cleanliness.
Avoid overcrowding, and do not run chicks of various ages together.

No definite length of time can be stated for brooding chicks, so much depends on variety of breed and climatic conditions, but under normal conditions six weeks should see them well over brooder troubles and fit to be put in cosy rearing houses, where they should remain until twelve weeks old. They are then fit to go into the colony houses and have free range.

FEEDING CHICKS.

For the first few days chicks should be fed every two hours with oatmeal. Flaked oatmeal broken up with the hands is best. After the third day oatmeal may be dispensed with and grains substituted. The following is a good growing ration:—

14 lbs. finely cracked wheat.
1 lb. canary seed.
½ lb. linseed.
½ lb. hemp-seed.
½ lb. millet.
1 lb. finely ground shellgrit and a little charcoal.

The object in giving a variety of seeds is to make chicks eat more than would be the case if cracked wheat only was supplied. If the seeds abovementioned are not available, it will be advantageous to purchase ready mixed chick food from a reliable merchant. When the chicks are four weeks old, grain mixture should be stopped, and they may be fed with the same food as adult stock. If it is intended to feed them on dry mash when placed out on colony range, a small hopper may be made of a kerosene tin, and should be filled with mash and left in the run, allowing the chicks to help themselves when so inclined. Clean water and shellgrit should also always be available, and animal food is just as necessary for chicks as for adult stock. A little raw meat finely minced is the best to start them with. Green food is essential, but if none is available well steamed lucerne chaff will answer the purpose. White diarrhœa is the worst foe young chicks have to fight, but this may be guarded against if proper precautions are taken from the start. Avoid over-crowding, over-heating, chilling, feeding too soon, improper feeding, wet and sloppy foods, want of exercise, and insanitary conditions. Any neglect of these important matters may result in severe losses.

It is the rearing of the young, perhaps more than any other factor, which tends to make the success or otherwise of poultry-keeping. Without good care and management of the stock while young, they cannot make the development which is essential, if they are to be a profitable asset to the farm at a later stage.

HINTS FOR POULTRY FARMERS.

1. Breed early.
2. Breed only from strong healthy stock.
3. Practise line breeding with selection.
4. Have the water clean and cool.
5. Keep the houses clean and dry and free from pests.
6. Do not overcrowd. Fowls will lay better and enjoy better health when they have ample room.
7. Remove male birds from the flock as soon as the breeding season is over, and dispose of cockerels as soon as they are of marketable age.

8. Provide good shelter from the summer heat, and shelter from cold winds.

9. Do not waste time trying to cure persistent cases of disease.

10. Do not have birds of all ages running together.

12. Do not keep old hens when they have outlived their usefulness.

12. Have a plentiful supply of nest boxes in or near the fowl-house, and see that they are kept clean.

13. Collect eggs at least once a day, and do not leave any in nests over night.

14. Do not market eggs found in stolen nests. There is no knowing how long since they were laid, and consumers do not appreciate stale eggs.

15. Give chicks free range as soon as possible. An active life while growing will build up a robust constitution.

16. Avoid spices and condiments. Good, sound, wholesome food contains all that is requisite for high egg production.

17. Isolate all sick birds, and give immediate treatment.

18. Fowls do not require continual doctoring. A good tonic occasionally is all that is necessary.

19. As it costs no more to keep a good fowl than a bad one, keep only the best.

THE VEGETABLE GARDEN.

H. D. LARWOOD,
Assistant Potato Inspector.

There are two distinct phases to this almost unlimited subject, viz., "The Market Garden" and "The Kitchen Garden." While the general methods adopted for market gardening will also apply to kitchen gardening, there are many methods which can be used to advantage in the kitchen garden that would be found unworkable in the market garden, and also economically unsound. Improved methods of culture are being used by up-to-date gardeners, but owing to the varying nature of soils in our large State, the varied rainfall, and extended coastline, it is a most difficult problem to outline standard methods which will give encouraging results over the vast areas in Western Australia.

The methods referred to in this article will apply to the area surrounding the metropolis. The general advice will be useful for earlier application in the country extending to the North, or later application in the Southern areas.

Three essentials, Determination, Water, and Work, are requisite to success. Without determination, it is useless to expect water and work to

be wholly effective. We have a perfect climate, and a large area of good garden land. Almost any soil in our large State, with the requisite plant food applied planted with seasonable produce, and intelligently worked, will be found profitable to cultivate.

SELECTION OF SOIL.

A soil in which an easily maintained tilth is obtained and promotes seed germination along with the establishment of the young seedling, while facilitating deep rooting of the growing plant, will be found most satisfactory. The soil should be porus, well drained, and if not naturally moist it should allow of irrigation without becoming sour. Soil of this description may not necessarily be rich soil, but can be improved by the application of manures. For winter gardening select a spot with an Eastern aspect, that is land sloping in an Easterly direction. While ideal soil simplifies matters considerably, almost any soil can be worked up to produce good results. No one need despair because he has not the land with the ideals mentioned. Almost every defect of the soil can be overcome with proper treatment.

IMPROVEMENT OF SOIL.

A few suggestions for improving the texture of the soil may be beneficial. The improvement of light sandy soils is perhaps of most importance to metropolitan gardeners. The most necessary adjunct to the improvement of our sand soils is a plentiful supply of well rotted and decayed manure worked well into the soil. This, with the application of artificial manures during the growing period, will be the chief factor to ensure success. During the winter months sufficient rain will fall to supply moisture, but during the summer months an irrigation scheme must be provided. For clayey soils and free use of air-slaked lime, applied about the time of the first rains, is the first and simplest effort towards breaking up the tenacity of the soil. This should be done no matter what greater efforts are to be undertaken later. Deep and thorough tillage just when the moisture conditions allow of a good ploughing and harrowing will improve the tilth. Cultivate after each heavy rain to prevent the sun from baking the crust, and adopt the ridging method when planting, *i.e.*, three or four furrows and then a furrow drain. Thoroughly drain the soil to three or four feet deep. Use tiles if possible, making the drains about twenty feet apart, varying the distance as the land requires. If tiles are not available, open ditches should be made. Drainage improves the friability of the soil and renders it more workable by the quick removal of excess water, thus promoting seed germination and plant growth. Plough or dig into the soil as much coarse material as possible —farmyard manure, straw, leaf refuse, sand, ashes, almost anything of a coarse nature which will break up the fine clay particles.

RAISING SEEDLINGS FOR TRANSPLANTING.

(Cabbage, Cauliflowers, Tomatoes, Onions, Lettuce, etc.)

Select a well-drained rich soil, work it into a fine tilth, and arrange the beds about two feet six inches wide and of any length, leaving a small track about nine inches wide as a path between. The beds should be higher than the path. Raise the edges of the beds to prevent the water running off while watering. The beds, being narrow, will allow freedom in watering and weeding.

Do not sow the seed too thickly, but thick enough to allow one inch to two inches between each plant. After sowing the seed, cover the beds with a quarter of an inch of light soil, preferably sand, as sand has been found to be the best for the germination of seed. Keep the beds free from weeds and water them well, care being taken not to over-water and cause the ground to become water logged. If the young plants show retarded growth at any stage, water with a solution of sulphate of ammonia (a large handful to four gallons of water), which will revive them.

TRANSPLANTING.

When the plants have attained a height of about four to six inches they are ready for transplanting. They should be hardened for about a week before transplanting takes place; this is done by decreasing the watering, but sufficient must be given to keep the plants alive. Water the plants before lifting. When lifting use a small trowel or fork. Care must be taken to allow as little air to the roots as possible. This can best be done by lifting the plants with as much soil as possible adhering to the roots and placing them directly into a case or vessel, then remove to the permanent bed. During the summer the transplanting should be done towards evening in order to give the roots of the young plants a chance to make a start during the cooler conditions of the night.

MANURING.

The majority of vegetable plants are gross feeders, and their successful culture depends largely on the amount of plant food available. As a base manure use as much farmyard or stable manure as possible. During the winter months it is advisable to top dress with artificial manures such as blood and bone. Carrots, parsnips, beetroot, etc., will benefit materially in growth if given two light dressings of about 5 to 10 cwt. per acre twice during the growing period with blood and bone. Cabbage, and especially cauliflowers, which must not receive any check during the growing period after transplanting, will thrive if given a dressing of sulphate of ammonia every three weeks after being transplanted out a month. Use a large handful to 30 or 40 plants, or dissolve the same quantity in four gallons of water and apply to same number of plants. When applying in a dry form keep the sulphate of ammonia several inches away from the plant, as contact with the leaves will usually burn them.

WHAT AND WHEN TO PLANT.

(*April.*)

Sow in beds for transplanting—Cabbage: Large White Brunswick, Succession (Henderson's), St. John's Day, East Ham. Cauliflowers: Early London, Early Erfurt, Early Short-stemmed Grant. Onions: Brown Spanish, Brown Globe, Yellow Denver, White Queen, Silver Skin and Early Barletta. Leeks: Large American Flag. Shallots: Purchase well-matured bulbs. Lettuce: New York and Neapolitan.

Plant in the open—Turnips: Purple Top, White Globe, Snowball, White Stone and Strapleaf. Swede Turnip: Skirving's Purple Top, Mammoth, and Monarch. Carrots: James' Intermediate, Long Red, Altringham, Early Horn, and Ox Heart. Parsnips: Hollow Crown and The Student. Beetroot:

DIBBLING WITH A SPADE.

The soil on one side is firmed as the hole is made.

The soil on the other side is firmed by pressure of the foot after the plant is inserted.

A MULCHING EXPERIMENT.

Egyptian, Turnip Rooted, Eclipse, and Long Red Erfurt. Rhubarb: carefully select roots of winter varieties such as Metcalfe's Winter, Roselea Winter, and Topp's Winter. Peas: Sow William Hurst, American Wonder, and Yorkshire Hero. Broad Beans: Early Long Pod and Broad Windsor.

Transplant—Onions, Leeks, Cabbage, and Cauliflower.

(*May.*)

Sow—Cabbages, Turnips, Swedes, Beet, Carrots, Parsnips, Lettuce, Peas, Broad Beans; and, where free from frost, Potatoes: Delaware, Bismarck, and Carmen.

Transplant—Cabbages, Cauliflowers, Onions, and Leeks.

(*June.*)

Sow same as for May, and prepare hot bed for early Tomatoes. Bulletin available on application. Plant Large Red (wrinkled variety).

When planting parsnips, carrots, beetroot, swede turnips, and other root vegetables it is a good plan to plant the seeds in drills made from 10 to 15 inches apart. Draw out the drills with a home-made marker. Take a piece of 4in. by 1½in. of any heavy timber about 4 feet long and secure four pointed pieces of 3 by 1 about 8 inches long similar to the tops of fencing pickets, and fix a handle to the main piece of 4in. by 1½in., bracing the handle to the end piece by wire or smaller timber. Make the drills about 1½ inches deep, and run the seed into the drills between the thumb and first and third fingers. Cover the seed with a light raking, and during the summer months roll the soil after planting.

A DEMONSTRATION WITH MULCHES.

Gerald L. Throssell, Dipl. Agric.
Cadet, Department of Agriculture.

In order to illustrate a lecture given by the Director on "The Home Garden" in connection with the Short Course on Rural Household Science recently held at the W.A. University, a demonstration was conducted in order to show the beneficial effect of three different mulches in reducing the amount of water lost from a soil surface by evaporation.

For the purpose of this demonstration four galvanised iron cylinders four inches in diameter and eighteen inches long were filled with moist loamy soil. The soil in the cylinders was packed firmly by "dumping" and by pouring water on the top to consolidate the particles and establish capillarity. The cylinders were fitted with a water jacket five inches high at the bottom. The lower parts of the cylinders were perforated so as to provide a connection between the soil and the water.

After filling the cylinders and compacting the soil they were mulched according to the following scheme.

No. 1.—This was the control and was not mulched. The soil remained compact throughout.

No. 2.—This had a soil mulch made by stirring daily the soil to a depth of two inches.

No. 3.—This was covered with one inch of stable manure.

No. 4.—This was covered with one inch of grass cuttings.

The cylinders were weighed prior to the commencement of the experiment, and each morning throughout its course any loss of weight recorded, this loss representing the water lost by evaporation from the top of the soil or from the mulch. The water lost from any cylinder was replaced daily so as to have each cylinder at its original weight at the beginning of each day. The experiment was commenced on 26th February and continued until 12th March, 1924, a period of fourteen days. The loss in weight from each cylinder and the equivalents in inches of rain are shown in the table hereunder:—

No. of Cylinder.	Type of Mulch	Weight of Water lost by Evaporation.	Equivalent to inches of rain.	Inches saved by Mulch.
		lbs.		
1	No mulch (check)	2½	5	...
2	Two inch soil mulch	¾	1½	3½
3	One inch manure mulch ...	½	1	4
4	One inch grass mulch	¼	½	4½

These results show in a striking way how very effective mulches can be in conserving moisture for the use of garden or farm crops. The results obtained show how powerful is the force of capillarity, for in 14 days it caused the equivalent of five inches of rain to be raised through a column of soil 18 inches high. Very rarely indeed would the conditions in the garden or field be the same as in this demonstration, nevertheless the results illustrate in a very striking manner that a large quantity of water can be brought from the subsoil by capillarity and lost by evaporation. Fortunately for those with a limited supply of water available the demonstration shows in an equally striking way how very effective mulches can be in conserving the moisture in the soil for the use of garden plants or farm crops. In this instance the most effective mulch was the grass clippings—this because mulches to be most effective must be loose and dry, and they remained loose and

resisted to the greatest extent the tendency to become compact better than the mulches of stable manure and soil, which were of much closer texture. Owing to the great activity of capillarity due to the special conditions of the demonstration, the tendency of these mulches to become compact and therefore less effective was greater than would obtain normally.

The light and loose nature of the grass clippings which made them so effective a mulch in the demonstration render them unsuitable generally for practical application for they would be blown away. Other loose material, *e.g.*, small shells or shingle, would be equally effective, and in some instances are available. For garden purposes stable manure is nearly always available. It is very effective, and has the additional advantage that it enriches as well as mulches the soil. When other mulches are not available the gardener can always fall back on the soil mulch. This, however, requires periodical stirring, and especially after watering or rain to keep it loose and dry.

Whatever mulch is used the gardener has the comforting knowledge that if properly maintained much precious moisture is being saved for use by precious plants.

APICULTURE.

H. L. Cailes,
Inspector Orchards and Bees.

The 1923-24 season for bee farming is now rapidly closing, and bee-keepers throughout the Commonwealth have experienced a very poor season indeed. In many instances their honey returns have been nil, and quite a number of apiarists of but a few years' standing have been tempted to part with their bees if they have not already lost them from starvation, etc.

The commercial bee-keepers were more fortunate, and I would urge on all and sundry to winter every available colony, as there are brighter prospects ahead. The average annual honey returns of the careful and industrious bee-keeper, apart from seasons like the present, are sufficiently attractive to help us quickly over occasional periods of non-productiveness. Seasons like this, although undesirable, might be put to good account, and although the experience gained is more or less costly, we may be caught again under similar conditions when success hinges on adaptability to the vagaries of Nature and a closer study of nature's laws.

Most of the present season's losses might be avoided if the apiarist would only take the time and pains to acquaint himself with the habits and behaviour of honey and pollen-producing plants. The season 1922-33 gave us a superabundance of nectar from nearly all sources, particularly the Eucalypts, the latter yielding almost the whole of our commercial honey. Similar conditions prevailed during the 1921-22 season in many districts, and one could hardly expect a repetition of these conditions for three years in succession. With the exception of those varieties of Eucalypts and plants which

flower annually, we gather our commercial quantities of honey at rather spasmodic periods unless we practice migratory bee-keeping, *i.e.*, moving bees from one locality to another in order to secure any nectar that may be offering from either tree blooms or ground flora. Moving one's stock in this way, of course, entails considerable work and forethought. A thorough knowledge of bee-life is required and the periods and sources from which payable honey yields can be obtained are, of course, essential factors governing success.

A person taking up bee-keeping as his sole means of support must not expect the best results unless he has acquired the above-mentioned knowledge, and then when dearth periods arise, he is able to make the best of an unpleasant situation, and should other pastures give promise of better results, he is able to move up to them, even if it is only for a few weeks, and thus secure good returns of honey, etc. This method of bee-keeping may be practised more or less in all parts of our outer suburban and agricultural areas, and particularly in the latter, and when this is done we do not feel very much the effect of a poor season like the present one.

Bee-keepers, both large and small, are urged to winter every colony that they possibly can.

In the writer's experience of 20 years bee-keeping in this State it has been noticed that we usually have a cycle of what may be termed good seasons after such conditions as have prevailed on this occasion, and should next year only prove equal to our expectations, practical apiarists will soon forget the time when there was no honey to add to the bread and butter.

There are seasons when we may say with confidence that there will be a large amount of bloom for our bees to work on, but we can never say for certain that a large amount of bloom will produce a correspondingly copious flow of nectar, for the latter has the habit of not being there sometimes when we think conditions are ideal for its secretion. Climatic conditions are the governing feature in this connection. Although a normal nectar-producing bloom from any source might safely be expected to bring with it some sort of a return to the apiarist, to succeed we must learn the value of all plants, trees and shrubs likely to be visited by our bees, and, having gained this information, we are in a position to prepare our bees in time to secure the maximum amount of nectar that might be available.

Here is an instance: A kept 50 colonies last season. His honey flow came on during February and March from Marri (*Eucalyptus calophylla*) commonly known as Red Gum. He had ample time to give to his bees, but did not like it, and he extracted 50 tins each containing 60 lbs. of honey from his apiary. B kept 50 colonies on the adjoining block, and his bees worked over the same area as those of his neighbour, but he attended to them prior to and during the honey flow, and he obtained 150 60lb. tins of honey, or an average of 180 lbs. per colony. These apiaries were kept as a sideline to fruitgrowing and the immediate locality was not an ideal one for bee-keeping. Marri, or Red Gum, provided the main nectar flow and came on late in the season, and while one man slept over his work the other was able to reap the rewards of his watchfulness. Had A displayed as much knowledge and desire for his work as did B his returns would have been just as good. The bees nor the seasons are not always to blame for failures. Procrastination in work connected with the apiary will always manifest itself in a loss in some way or other.

Apiculture as an industry in Western Australia is now coming into its own. Our commercial bee-keepers are men of practical methods and long experience and they are quite satisfied and zealous over their calling. There is room for considerable expansion in this industry, and also need for co-operation on the part of those already engaged in the production of apiarian products. There is probably no other industry that lends itself better to co-operative methods than apiculture, because of the non-perishable nature of its products, and co-operative organisation will help to eliminate poor grade honey from our markets, to stabilise the marketing of our goods and assist to control bee diseases throughout the Commonwealth. Many people condemn Western Australian honey as being inferior to that of other countries, but few know what types of honey are being produced, whence it came, or the source from which it was gathered. All countries and localities produce honey that varies in colour, flavour, density, etc., but if consumers knew what to ask for they would be agreeably surprised at the quality of the article produced in this State. Western Australian honey is being exported to the Eastern States at highly remunerative prices, and our bee-keepers need have no fear from outside competition when once they are properly organised.

Seasonal Notes.

By the time this *Journal* reaches its readers the season's operations will be over in most localities, and apiarists, if they have not already done so, will be closing their stocks down for winter. For beginners and those inexperienced generally, I would advise that all colonies be examined thoroughly to ascertain the condition of the queens and the amount of stores each colony possesses. Any stocks that are short should either be fed with a heavy honey or sugar syrup until they have enough to carry them through winter safely; or, better still, be given combs of sealed honey, if these are available. When feeding honey at any time be careful to guard against infection from foul brood, as germs are often disseminated per medium of the food supply.

In most districts the prospects of a good spring flow are already in evidence, and a few shillings per colony spent in providing winter feed will return good interest before the end of the year. Leaky and draughty hives should be remedied, and, if possible, they should be painted, for it adds many years' service to hives and general equipment if attended to properly.

For those who intend to increase the size of their apiaries next season, the winter months can be employed profitably by preparing all new appliances likely to be required, in addition to renovating all damaged goods from the previous season. If this is done the making of increase is no way delayed, and many desirable queens and queen-cells can be saved when hives are on hand ready to accommodate them. Needless to say we can never get the best results if we have to prepare a hive while the swarm is in the air. Any old or failing queens should be noted and replaced as soon as practicable. Practical apiarists realise that the whole of their success in a sense depends on the type and vigour of the queen contained in the colony, and only the very best should suffice. Very few queens are worth keeping after their second season unless it is for breeding purposes, i.e., either for their queens or drones, and in some localities it may be advisable to re-queen every year. If the apiarist knows his locality he will be the better judge of the latter condition.

DUSTING WHEAT TO PREVENT SMUT.

Because of the simplicity and effectiveness of the treatment of wheat with copper carbonate to prevent smut, the method was regarded as practically proof against error. Evidence has come to hand that this impression is wrong. Cases have occurred where farmers, when using copper carbonate, have placed it in the box of the seed drill with the seed. This is abusing a method of treatment that is simplicity itself, and the practice will certainly fail to achieve its purpose if the seed contains smut. The effectiveness of the copper carbonate in preventing smut depends upon the powder being thoroughly dusted over the seed and coming into contact with the smut spores adhering to the grains, and unless a thorough mixing takes place this contact may not occur. By merely placing the powder and seed together in the seed box of the drill this necessary contact does not occur with a large percentage of the seed.

REGISTRATION OF BULLS UNDER THE DAIRY CATTLE IMPROVEMENT ACT.

In view of the fact that there has been great neglect on the part of many settlers to make application for the registration of bulls under the "Dairy Cattle Improvement Act," which came into operation during the year 1923, the Hon. Minister for Agriculture has approved that those who applied for registration of their bulls during 1923 shall be permitted to have such registration carried over to 1924 without re-registration or additional fee for this year. The Department of Agriculture, however, desires to stress that all bulls over the age of nine months must be registered annually under the "Dairy Cattle Improvement Act," the fees being 5s. per annum, and that owners of unregistered bulls will be prosecuted if they neglect to immediately apply for registration of their bulls for this year. All persons concerned are particularly requested to note that this represents final notice and that prosecution will be instituted in all cases where owners neglect to make application and are found in possession of unregistered bulls. Application forms may be obtained from the Department of Agriculture, Perth.

F.A.Q. Wheat, 1924.—The fair average quality standards of wheat for the various States for the 1924 season have been determined by the Chambers of Commerce in accordance with the practice which has been in vogue since 1893. Under the method by which the standard is fixed, samples of wheat from receiving stations throughout an individual State are thoroughly mixed by members of the local Chambers. It is then weighed in a bushel container. The standards for the individual States for the 1923-4 season have been fixed as follows:—W.A. 62¾lb.; S.A. 61½lb.; Vic. 61lb.; N.S.W. 60½lb.

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

List of Bulletins available for Distribution.

No. 20.—"The Pruning of Fruit Trees." By J. F. Moody. Price 2s. 6d.
No. 46.—"Fruit Packing and Marketing and Exporting of Fruit." By J. F. Moody and J. Ramage. Price 1s. 6d.
No. 47.—"The Poultry Keeper's Manual." By G. Allman. Price 1s.
No. 83.—"Horticulture and Viticulture." By A. Despeissis. Price 2s.
No. 5.—"Fruit Drying." By J. F. Moody. Free.
No. 15.—"Root Rot." By A. J. Despeissis. Free.
No. 24.—"Hints to Stock Breeders" (revised). By R. E. Weir. Free.
No. 30.—"Descriptive Account of the Codlin Moth." By L. J. Newman. Free.
No. 37.—"Conference of Producers, 1912."
No. 41.—"Irrigation and Drainage." By A. H. Scott. Free.
No. 49.—"The Feeding of Horses." By Professor Paterson and G. L. Sutton. Free.
No. 57.—"Vermin Destruction." By A. Crawford. Free.
No. 59.—"Alleged Deterioration of Local Superphosphate." By G. L. Sutton. Free.
No. 60.—"The Farmer's Clip." By J. J. Mahood. Free.
No. 63.—"Field Experiments with Wheat at Experimental Farms." By G. L. Sutton. Free.
No. 68.—"Flaying and Treatment of Hides." By R. E. Weir. Free.
No. 71.—"Wheat Smuts and their Prevention." By G. L. Sutton. Free.
No. 72.—"The Potato: Its Cultivation, Pests and Diseases." By G. N. Lowe, L. J. Newman, D. A. Herbert. Free.
No. 73.—"The Success of Dairying in W.A." By P. G. Hampshire. Free.
No. 74.—"Tobacco Growing: Notes for Intending Planters." By G. W. Wickens. Free.
No. 79.—"Sheep on the Wheat Farm and their Management in W.A." By H. McCallum. Free.
No. 81.—"The Improvement of Pastures." By E. A. Mann and D. A. Herbert. Free.
No. 84.—"Tomatoes: Their Culture in W.A." By H. D. Larwood. Free.
No. 86.—"Notes on Fertilisers." By P. G. Wicken. Free.
No. 87.—"Sheep Feeding Experiments: State Farm, Chapman, 1920." By G. L. Sutton and F. Vanzetti. Free.
No. 88.—"Light Land: Conference." By G. L. Sutton. Free.
No. 90.—"Stock Waters: Standard for Composition of." By E. A. Mann. Free.
No. 91.—"Dairy Premises." By P. G. Hampshire. Free.
No. 93.—"The Home Tanning of Sheep and other Skins." By H. Salt. Free.
No. 94.—"The Dingo." By B. W. Leake. Free.
No. 96.—"Poison Plants of W.A." By D. A. Herbert. Free.
No. 99.—"Australian White." By G. L. Sutton. Free.
No. 101.—"Cotton Cultivation." By G. L. Sutton. Free.
No. 102.—"Dry Treatment of Smut." By F. Vanzetti. Free.
No. 103.—"Kerosene Method for Eradicating Zamia Palm." By G. K. Baron-Hay Free.
No. 104.—"Stickfast Flea." By J. G. C. Campbell. Free.
No. 105.—"Pedigree Selection of Seed." By G. L. Sutton. Free.
No. 106.—"The Red Legged Velvet Earth Mite." By L. J. Newman. Free.
No. 107.—"Sudan Grass." By G. L. Sutton. Free.
No. 108.—"Lucerne." By G. L. Sutton. Free.
No. 109.—"Rape." By G. L. Sutton. Free.
No. 110.—"Subterranean Clover." By G. K. Baron-Hay. Free.
No. 111.—"Standard Wheat Varieties." By G. L. Sutton and F. Vanzetti. Free.
No. 112.—"Automatic Device for Eradication of Stickfast Flea." By G. Allman. Free.
No. 113.—"Picked Pieces (Classification of Clip)." Free.
No. 114.—"Blue Mould on Citrus Fruits." By W. M. Carne. Free.
No. 115.—"The Value of Windmills for pumping water in W.A." A. H. Scott.
No. 116.—"Spotted Wilt of Tomatoes." W. M. Carne.
No. 117.—"Cream." P. G. Hampshire.
No. 118.—"Pigs and Pig Raising." P. G. Hampshire.
No. 119.—"Take-all of Wheat and Similar Diseases of Cereals." By W. M. Carne and J. G. C. Campbell.
No. 120.—"Pastures in the South-West." A. B. Adams.
No. 121.—"Mildew, Septoria, Leaf Spots, and Similar Diseases of Cereals." W. M. Carne.

The following publications may be obtained from the Department of Agriculture, Perth, on application, or will be sent post free to any address in this State on receipt of a remittance for the amounts stated:—

"The Handbook of Horticulture and Viticulture of Western Australia," by A. Despeissis, M.R.A.C.:

This publication contains valuable information dealing with all commercial fruits grown in Western Australia, including advice on planting, pruning, packing, manuring, fruit-drying, wine-making, insect and fungoid pests and their treatment, etc., and the whole forms a text book which every fruitgrower, whether large or small, should have in his possession. The price originally was 8s. 6d., but to allow of distribution being as wide as possible, it has been reduced to 2s.

"The Pruning of Fruit Trees," by J. F. Moody, Fruit Industries Commissioner:

This publication contains numerous illustrations, being reproduction of photographs taken in this State, of pruned and unpruned trees, which make the details set out in the letterpress particularly easy to understand. Price, 2s. 6d.

"Fruit Packing and the Marketing and Exporting of Fruit," by J. F. Moody, Fruit Industries Commissioner, and J. Ramage, Packing Instructor:

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